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[OFFICIAL NOTICE.]

Central New York Gas Engineers' Association.

The Second Annual Meeting of the Central New York Gas Engineers' Association, will be held at the Osborne House, Auburn, New York, Wednesday, May 18, at 11:30 A.M. A paper will be read by Mr. W. A. Wood, of Syracuse, in continuation of his late paper on the "Stoppage of Stand Pipes." Other papers will also be presented.

It is earnestly requested that every member will be in attendance, and use every endeavor to make the meeting a profitable one. Election will be held for officers to serve during the ensuing year. CLEMENT A. WHITE,
Secretary.

IMPROVEMENTS IN GAS BURNERS.

That great advances have been made in the construction of burners for the consumption of large quantities of gas, during the past two years, is patent to all conversant with the question of illumination, and it is evident there will be a further and great development of these burners to meet the present and future demands of the public.

Indeed, within a few months, the adaptation of the regenerative principle to burners of large size, by Mr. F. Siemens of Dresden, has opened a path that may be followed with great promise of extraordinary results. M. Cornault recently read a paper, before the French Society of Civil Engineers upon this burner, in which he gives a table showing that the light of more than eight candles per cubic foot of gas consumed was obtained, and burners are being constructed that will do still better. A lantern to surround these burners has been produced in Paris, that leaves nothing to be desired in the way of taste and fitness. In this connection we note that the Paris gas company, as shown by the statements in their annual report of March 29, 1881, have already placed on the public lamps 331 burners, each consuming from 30 to 50 cubic feet per hour, and 697 burners of the same kind are used by many of the shops, cafés, theatres and restaurants. Thus, in Paris, more than a thousand burners demonstrate nightly the ability of gas companies to furnish economical lights of great power.

There is, we believe, with the best burners at present devised, a great waste of the light possible to be obtained from the quantity of gas consumed. A well-managed gas company delivers at the burners of its consumers more than sixty per cent. of the energy of the coal from which its gas is derived, allowance being made for the residuals. Electricians, with the most improved boilers, engines, dynamo-electric machines and distributing plant, cannot deliver to the electric lamp near ten per cent. of the energy of the coal by the combustion of which their electricity is produced. Yet, there is such a loss in warming the air and stirring the luminiferous ether in a gas flame, that, with one-horse power of energy at the burner, used in the combustion of gas, there is produced a light of about thirty candles; whereas, an electrician, with the same energy, at the same point, may produce the light of (when intensity and not quantity of light is considered) not far from one thousand candles.

Of course, these figures do not represent a basis for estimating the comparative commercial economy of the systems for producing light, they merely show, in the case of the gas consumed, a loss of energy, where light is required, in the production of invisible heat rays, and it is probable that, in making these heat rays help in the production of light, more than now, future economies in large burners will be obtained.

By far the more important field, however, is the improvement of burners for the consumption of limited quantities of gas, such as are in general use where a comparatively small amount of light is required. In the construction of these burners consideration must be had of the questions of quantity and intensity of light, uniformity of consumption under varying gas pressures and the removal of the products of combustion.

The promise for the future improvement of such burners can be estimated somewhat when we remember the advances made in the past ten years, as, notwithstanding the comparatively little attention given the subject by inventors and scientists, low-priced burners are now produced that give an illuminating power from thirty to forty per cent. greater than was formerly obtained.

We have no doubt if the attention of our inventors was turned in this direction they would advance decidedly on what has heretofore been done. The American mind has, when called upon by necessity, shown itself capable of grasping and solving much more complex problems than here presented. But in this direction our inventors have not at all kept pace with the requirements of the day, indeed we are not familiar with any remarkable burner of strictly American origin.

We believe this state of affairs is partly due to the past too conservative action of our gas companies and gas associations. Sufficient inducements have not been made to inventors, nor have we generally introduced apparatus elsewhere adopted and recognized as efficient. There is now a great demand for lights of the large type—how many are there on our streets today? We think it to be unwise for a company to lose any of its public or private lights, unless under exceptional conditions. We do not consider, however, a demand for larger lights, or for the erection of lights, in confined places, that will not contaminate or heat the space lighted, as unreasonable or exceptional.

Our great industry will become greater and more and more important if we meet, as we easily can, the requirements of the day. We have been acting too much on the defensive, we must become more aggressive.

PROGRESS OF GAS LIGHTING.

From time to time we have given accounts of the various systems of electric lighting as they have come up and taken their places in the great host of competitors for public favor, public improvement, and a greater or less share of the contents of the public press. The number of companies and systems goes on increasing; the nominal capital invested, however, often bears an extremely large ratio to the actually paid up in hard cash. With some few cases the object is to really sell light or lighting apparatus, while, with others, the more immediate object is to sell the *rights* to work under the patents that may have been obtained. It is not to be denied that money may be made in this way; and, doubtless, cautious ones have already realized some profit from the rise and fall of shares.

The problem of illumination by electricity resolves itself into two general systems, as is well known, viz., that by the "arc lights," where large illuminating powers are obtained, and that by the "incandescent" system, which aims to use small lights which shall give a more or less perfect resemblance to gas light. Of the first class there are a number of quite successful examples in practical operation both in this country and abroad. Of the second class a few working examples may be seen in this country while, as yet, we are not aware of any practical tests on a working scale elsewhere.

Of one thing a very fair judgment may be formed, viz., as to the amount of light to be obtained by the different systems, and, in a general way, it may be stated to be about as follows:

With the arc system one thousand candles may be obtained with the expenditure of one horse power of motive force per hour. With the incandescent system the expenditure of one horse power of motive force per hour yields about one hundred candles. It is apparent that the two systems are calculated to serve in different circumstances and, as yet, nothing is known of the cost of distribution, care and maintenance. What is the effect of all this upon the gas industry of the day. We say, most emphatically, its influence has been for *good*.

In the first place it has aroused a spirit of inquiry and improvement all over the world amongst gas makers. The supineness of the indolent has been aroused by the constant inquiries of the cautious stockholder who, knowing nothing of the manufacture, fears everything and "wants to know about these things."

The wide-awake and progressive manager, however, keeping a general lookout for all that transpires around him, devotes his energy to improving his product, and cheapening its cost, expends very little time or zeal in worry and fret about things over which he has no control, and is ever ready to develop his own business and take the lead in the application of improvements. The introduction of electric lighting has created a demand for more general and intensate illumination, and this is being met most successfully by the improvement in quality of gas, but much more fully by proper use of it after it is made. The strides made in burners, improved to meet the cry for more light, are enormous. Not only the Sugg and Bray burners of large power have been developed by the electric light movement, but more recently Dr. Siemens has applied the regenerative principle to gas burners as well as to furnaces, and the results obtained have been very remarkable.

Some scientific societies in Paris have been recently making some comparative examinations of different systems, and the "Société des Ingenieurs Civils," of Paris, issued a pamphlet, on January 21st last, giving some results, which show the great improvements already made in this direction.

The general deduction to be drawn from the tables given is that while with the old-fashioned burner, such as is ordinarily used in the Paris street lamps, a light of 7.7 units was obtained, with the new Siemens burner, using the same quantity of gas, a light of 29 units was produced.

This simply quadruples the power of any gas, and puts the gas maker in a position four times more favorable for competition with lights of large power, where circumstances may render them desirable; or, in other words, to produce a light of 1000 candles, by the consumption of gas, only the same amount of gas is required to day, by the use of the Siemens burner, that would have been required for producing a light of 250 candles by methods in use before Dr. Siemens perfected his new burner.

The days of gas burning are by no means numbered; in fact, the business is but in its infancy, and as it grows it will develop and find new fields of usefulness, while serving in the old more efficiently and economically as its growth goes on. In all cases, where the test has been fairly made, gas has always asserted its superiority over the electric light in quality, character and beauty of illumination, and as the progress of gas lighting goes on the time may come when all will wonder that so little had been obtained from so powerful an agent as illuminating gas, and the explanation can only be that it was crudely and unscientifically employed until competition aroused its slumbering energies, and it shone forth in its true brilliancy and power.

The Virginia Meeting of the American Institute of Mining Engineers.

The following programme of exercises has been arranged for the Virginia Meeting of the American Institute of Mining Engineers:

Monday, May 30th—Opening session in the Staunton Opera House, at 8 o'clock P.M.

Tuesday, May 31st—Sessions of the Institute at 9 o'clock, A.M., at 3 and 7:30 P.M. At 1:30 P.M. an excursion will be made in carriages about the city, visiting the water works and the public institutions.

Wednesday, June 1st—Excursion over the Shenandoah Valley Railroad, visiting the Shenandoah Iron Works, Luray Cave and other points of interest.

Thursday, June 2d—Excursion over the Chesapeake and Ohio Railroad, visiting Ferrol, Longdale, Clifton Forge, Low Moor, and arriving at White Sulphur at 5:30 P.M. Session of the Institute at 8 P.M.

Friday, June 3d—Excursion over the Chesapeake and Ohio Railroad to the New River coal fields, visiting Quinnimont, Stone Cliff, Fire Creek, Sewell, Nuttallberg, and Hawk's Nest, where an opportunity will be given for a thorough examination of the Ansted coal mines; then through the Kanawha coal fields to Coalburg, returning to White Sulphur for the night.

Saturday, June 4th—Excursion over the Richmond and Allegheny Railroad from Williamson's to Balcony Falls, visiting the Natural Bridge of Virginia and returning to Williamsons in time to take the trains East and West.

Reduced rates of fare have been obtained from the Baltimore and Ohio Railroad from points on their line and it is expected that arrangements will be completed for reduced rates on other roads.

It is necessary that members should inform the Secretary of the Institute promptly of their intention of being present at the Staunton meeting, in order that certificates may be sent to them for the purchase of such excursion tickets as may be issued by the different railroad companies, and also that accommodations may be prepared for their comfort during the meeting.

Members are requested to give early notice to the Secretary of the papers they intend to present at this meeting, that they may be announced in a subsequent circular. It is expected that the discussion on steel rails, begun at the Philadelphia meeting, will be continued.

THOMAS M. DROWN,
Easton, Pa., May 6, 1881. *Secretary.*

Growth of the Gas Industry.

Three-quarters of a century ago, perhaps a little over five thousand dollars would have covered the total capital invested in illumination by coal gas throughout the world.

At the end of lost year the total of share and loan capital for London alone was about $65,000,000, and as most civilized places in the world have now their gas supply, the total amount of capital now invested may most probably exceed $500,000,000. Certainly coal gas presents the most astonishing instance of successful practical application that the history of science affords us.—*Engineering.*

BRIGGS, ON VENTILATION.—We have received from Prof. Robert Briggs, C.E., a copy of his paper on the subject of the "Ventilation of Halls of Audience," as lately read by him before the American Society of Civil Engineers.

[From the London "Journal of Gas Lighting."]

The Transport of Materials for Gas Works.

ILLUSTRATED BY THE PLANS OF THE YORK, NEWCATSTLE-ON-TYNE, AND BECKTON GAS WORKS.

By V. Wyatt,
Constructing Engineer to the Gas Light and Coke Company.

Fourth Article.—Beckton Gas Works.

These works have been described and delineated from time to time in the *Journal*, but not in their complete and present form, and with especial reference to the railway and other communications for supplying and carrying on the gas industry of the place. The means for the transport and delivery of heavy material are of the most modern and comprehensive character, and what with the river, pier, and quays, the port facilities, and the general railway and road arrangements, the manipulation and transfer of goods to and from the various parts of the works are effected with the utmost despatch, regularity, and economy at all hours of the day and night. It could only happen with such a powerful gas company as the one who possess and have had the courage and resources to build so great an undertaking, that such a gas factory were possible and feasible; having to supply, as these works do, the gas necessities of upward of one-third of the metropolis, or say nearly two millions of people. In laying out and constructing the details of the Beckton works, the writer had always present to his mind the almost unlimited demands, so constantly growing, of such a population as London alone presents, and therefore the different sections of the works have been scheemed and carried out with such an amplitude of form, detail, and space, as to preclude as much as possible, in the future, the destruction and clearing away of the earlier lines of the establishment in making room for the extensions. All has been made and arranged to work in with great future growth, and a more than ordinary increase of output of gas and products for metropolitan wants.

The port of Beckton has been entirely created and evolved, as it were, from the mud banks of the Thames, on part of the Essex Marshes, situated about a mile below Woolwich; and where are to be found all the river facilities approaching the Port of London, for the passage and reception of the largest vessels and steam colliers. The site is also of avail and service through all the months of the year; the severity of the season being but a slight impediment to the regular work of the port. As an instance of the open character of this port during the past winter, the derricks in the river Thames, constructed especially for the unloading of household and other coals coming into the river, were stopped during the recent severe frost, whereas the Beckton pier and machinery for unloading coals were in full operation and serving every ship that came alongside.

The works completed at the port have been most efficiently carried out; and, for the trade carried on, at a very moderate cost, compared with the ports where the same amount of business is done. There is the river pier, which has a frontage parallel to the river Thames of about 800 feet, and projects forward to the low-water line about 400 feet at right angles to the river wall or quay, which latter is about 1,700 feet long. The upper platform, from which the coal and heavy traffic are received and despatched on to the works, stands 28 ft. 2 in. above the ordinary spring tides of the Thames, usually denominated at T. H. W. (Trinity high-water mark), the standard datum of the Port of London, and about 48 ft. 8 in. above low-water mark of same tides. The vertical rise of tide corresponding to an ordinary spring tide level is 20 ft. 6 in. at Beckton port; but there are on several days of the year exceptional tides which oscillate between the above level and a height of 4 ft. 8 in. above this standard. Consequently there is at times at Beckton a range of tide, allowing for the extra recessing of low-water mark, of nearly 30 feet.

The large tide which flowed on the 18th of January last, accompanied as it was with the great snowstorm, rose to the height of 4 ft. 8 in. above Trinity high-water mark. On this day the wind pressure was 51 lbs. per square foot, with a velocity of rather more than 100 miles per hour, putting to the severest test the gasholders and structures at Beckton. These, however, resisted the gale, and came off unscathed. This high periodical flood of tide water gives to Beckton, and all sites well down the river, great facilities for dealing with shipping and river craft of great tonnage.

The river pier has two decks—an upper one, at the level previously described of 28 ft. 2 in. above Trinity high-water mark, for the coal wagons and for the transit of trains; and a lower one, 12 ft. 6 in. below the upper deck, for the housing of the steam lifting and hydraulic machinery, and for other purposes. By an inspection of the plan which accompanies the present article it will be seen that there are accommodations and berths at the pier for five steam colliers of largest type, ranging as they do in tonnage from 900 to 2,400 tons. There are three ship berths on the front part of pier facing the river, and two inner berths, situated east and west of the centre line of the axis of the pier. The superstructure or upper deck carries three lines of single railway, parallel to the river front and to the ships when alongside; and the whole of the wagons on this level are taken from the locomotive trains as they arrive, detached and in piecemeal, manipulated at each end of the pier, east and west, over the three throw points and crossings, and adjusted and sent forward for loading under either the steam or hydraulic cranes. After the wagons are filled by the lifting machinery, they are marshalled off by curved routes on to their respective sidings, made up into trains of about 16 wagons each, in all carrying upward of 80 tons of coal net to a train, and away they go, hauled by the locomotive, to any one of the stages of the twelve retort houses, as the coals are signalled and wanted for carbonization.

The ordinary class of steam colliers arriving in the Thames are of about 100 tons burden, and are discharged and let go in one tide; but the larger class of ships, which approach to and exceed a tonnage of 2,000 tons, run into a second tide. The former class of ships are unloaded in from seven to eight hours when the wind and fog do not prevail to an excessive extent. The total capacity of the pier for unloading coal is very large, and probably it could transfer a bulk of 10,000 tons of coal in 24 hours from the ships into the wagons, and thence to the retort houses, wind, weather, and supply ships permitting. The power of the pier is only limited and controlled by the labor in filling the coal buckets in the ship's hold, and the manœuvring of the coal wagons under the cranes. The present output of coal in busy times reaches sometimes upward of 22,000 tons per week of six working days; and before the pier was increased in accommodation from two berths to five, the output of coal reached 18,000 tons per week from two ships' berths only. The present maximum consumption of coals per day of 24 hours at Beckton being under 3,000 tons at the busiest times, there is still a large margin of power at the pier for the rapidly growing factory wants at Beckton. A good margin of unloading power is absolutely necessary where weather and ships are important elements in the trade reckonings, and, in fact, this safety margin should never be less than 50 per cent. of the ordinary plant power required in the establishment.

Besides the common coal and cannel imports at the pier, there are the import and export wants of the manufactured products department—such as pitch, anthracene, ceosote, sulphate of ammonia, etc., which are growing rapidly, reaching an annual export at present of about 100,000 tons. These products are mostly handled at the middle berth of the front part of the pier, as the expedition with these is not of such vital importance as for the coal, and this berth is not so quickly operated as the others.

The vertical lift of the skips for unloading coal, etc., from the ships from extreme low-water line to a height sufficient to clear the coal wagons running on the upper deck is about 60 feet; but beyond this run-out of chain there is required, to facilitate the transfer of the skip along the bottom of the ship's hold, a further 30 feet of chain, making a total length of chain run out, for the extreme range of tide, of about 90 feet. This great run out of chain at times involves excessive speed of machinery and gearing to do the duty in the required time; in fact, the duty amounts to more than one skip or bucket per minute during the time of unloading, which short space of time includes the handling in the ship, lifting, reversing, and unloading the skip into the wagon. The lift itself must be performed at the rate of 60 feet in 10 seconds, and even somewhat quicker than this. The machinery for performing this work is divided into two groups, the one at the east or down-stream end of the pier being on the hydraulic system, and that at the west or up-stream end being the ordinary steam winches and cranes arrangement.

The reason of the present double system of hydraulic and steam working is that the western portion of the pier, being the first constructed, was arranged with steam machinery for two ships' berths only, and this has been operated by the six steam cranes for the past ten years and upward. When the western extension of the pier was carried out and brought into use in 1879, it was more in accordance with modern scientists' notions, and the economy of coal lifts, to adapt the hydraulic system for discharging cargoes, but of the feasibility of this course more will be said hereafter. At the east end and central part of the pier the hydraulic machinery is the motor, as before stated, and it is placed on the lower deck of the pier, over the central and eastern divisions. It may be premised here that the front section of the pier, parallel with the river, is constructed with two decks, an upper one, 44 feet wide over all, and a lower one, 36 feet wide over all, spaced 12½ feet vertically apart; the machinery generally for operating the pier, including the men's meal rooms, stores, and other offices, being on the lower deck, and the railways, cranes, and traffic plant being on the upper one.

The hydraulic machinery at the end of the pier was originally arranged and intended ultimately to work the entire pier of from 15 to 20 cranes, as occasion required, for five ships at one time alongside; but up to the present time it is only utilized for three of the ships' berths, the older steam

machinery at the west end being in full operation for the other two berths. The hydraulic system is composed of nine cranes, each crane having, as before stated, an extreme vertical lift of 60 feet, and a slack or run-out of chain for the ship's holds of 30 feet, making in all a total run out of 90 feet, with a sweep or radius to the crane of 20 feet. Each crane is situated on the upper deck, and lifts in the one operation about 13 cwt. of coal net, which, with the weight of the bucket included, weighs a little over a ton. The ordinary working capacity of each crane is about 40 tons of coal per hour, and there being three cranes generally to each ship, the work done and discharged is equal to about 120 tons per hour, being at the rate of about one skip per minute per crane, allowing for the necessary shifting of buckets, reversing, tipping, etc.

The hydraulic cranes are operated by two horizontal high-pressure double-cylinder pumping engines, placed upon the lower deck, each being equal to 75-horse power actual. The cylinders are 16 inches in diameter and 2-feet stroke, worked by steam of 50 lbs. pressure per square inch from the boilers. The force pumps are 4½ inches in diameter and 2-feet stroke, working with a water pressure of 700 lbs. per square inch, which raises the accumulator. Each engine can be run at a speed of 60 revolutions per minute, and each engine was intended to perform two-thirds of the entire duty of the pier, when the tide is at low water—that is to say, to operate ten cranes in full duty; but this would be a somewhat exaggerated value of its power in practical use, the number of six cranes being nearer its actual performance. To produce the steam for these engines there are six Galloway boilers, placed also upon the lower deck of the pier, each 5 ft. 3 in. diameter and 22 feet long, with an internal flue 2 ft. 9 in. diameter, and four conical Galloway tubes in each flue. The boilers are worked with steam of 50 lbs. pressure to the square inch.

The accumulator, which is situated at the eastern end of the pier, and the casing of which forms a lighthouse to guide the river craft, has a ram 17 inches in diameter, of 17-feet stroke, with the necessary relief valves and apparatus for governing the engine power by the rise and fall of the accumulator. It is weighted to give the necessary water pressure of 700 lbs. per square inch, by a dead load of pig iron slabs equal to a gross load of 75 tons, and sufficient to operate eight or ten cranes at one time in full work. If the hydraulic machinery had been utilized for the entire pier of from 15 to 20 cranes, it was contemplated to place a second accumulator at the western end of the pier, forming a similar lighthouse to the one at the east end of the pier, to guide the shipping in the river.

The nine hydraulic cranes are each controlled by a man in a crane-house on the upper deck of the pier. The pressure pipes for the hydraulic system are 4 inches in diameter inside, with 5-inch diameter return pipes to the water tanks in the engine houses. The lifting rams to the cranes, which operate by gearing placed between the two decks, are 7¼ inches in diameter, with cross-heads and sheaves to multiply ten to one, giving a stroke of 9 ft. to the ram, equal to a total run-out of chain of 90 feet, as before stated. The cylinders for these rams are 8½ inches in diameter. The lifting chains are made up of ¾-inch diameter best short links. The turning rams for reversing or swivelling round the coal buckets over the centres of coal wagons on the upper deck, are 4 inches in diameter, and multiply two to one, with a stroke of 4 feet, giving the crane a horizontal movement of one-third more than a complete turn. The cranes on the upper deck are of the tubular whip type, of wrought iron, to allow of the easy clearance of the wagons on the upper deck, and to prevent injury to the men moving on the platform of the upper deck. The ordinary Armstrong hydraulic crane, with its straight and unsightly jib and arrangements, is inapplicable to the Beckton pier routine, and is dangerously low in its details for expeditious work.

At the west end of the pier, which was the first portion of the pier finished, and brought into use in 1870, for the accommodation of two steam colliers at one time, the machinery for lifting the coals consists of six steam cranes. It may be mentioned here that the whole of the coal lifting at Beckton for about ten years, and until within the past eighteen months, has been performed by these six steam winches and cranes, and upward of four million tons of coal discharged by them in this period. This machinery has worked equably and well during the whole time, without hindrances or delays of serious import, both for the day and night duty; and the six cranes have occasionally unloaded between 3,000 and 4,000 tons of coal from the two berths in 24 hours, discharging four steam colliers in the time. The machinery situated on the lower deck of the pier for this section comprises six 1-ton capacity coal lifting winches, worked in conjunction with the six wrought iron whip shaped cranes, situated upon the upper deck. The steam cranes were designed to lift the coal at the rate of 300 feet per minute, to enable one bucket of coal, of from 12 to 13 cwt. net, to be handled and cleared in one minute. The cranes are spaced similarly to those of the hydraulic system, with respect to the ships' holds, at two centres of 51 feet and one centre of 38 feet, to suit the hatchways of the ships. The chains are formed of links with ¾-inch diameter iron, as at the east end of the pier. The steam winches have attached to them spirally grooved chain barrels, 2 feet in diameter and 2 feet long, and are actuated by annular wheels of 56 teeth, 1¼-inch pitch, 5½ inches wide, keyed on to them, and geared into shrouded pinions of 16 teeth, 5 inches wide, keyed on to the crank-shaft of the steam engines. Each winch or hoist has a pair of small steam engines, with cylinders 8½ inches in diameter and 10-inch stroke; working cranks at right angles to each other, with link reversing motion, actuated by working shafts and connecting rods from the lever cabins or crank houses situated on the upper deck. On each of the crank shafts is a small fly-wheel, the periphery of which is a brake, worked by a lever and treadle operated by the man in the lever cabin upon the upper deck.

Each steam winch is self-contained and quite independent of the others. The swivelling or reversing gear to each crane is actuated by a steam cylinder of 7-in. diameter and 3-ft. stroke, and is placed transversely to the centre line of the pier, being secured to the outside main girder of the structure. The cranes can swivel round either way, east or west, to suit the conditions of working the ships.

The six winches are supplied with steam from two 30-horse power Cornish multitubular boilers, each 18 ft. 10 in. long, exclusive of the smoke box, and 5 ft. in diameter. The furnace flue is 11 ft. 8 in. long and 3 ft. in diameter, terminating in 53 tubes 3 in. outside diameter and 7 ft. 3 in. long. There are two conical tubes to assist the circulation, crossing each other in the flue between the bridge and tube plate. The shell of the boilers is ⅞ in. thick, with end plates 7-16ths in. thick, flue plates ½ in., and tube plates ½ in. thick. The uptake or chimney is 66 ft. long and 2 ft. 6 in. diameter, running under the upper deck and through the centre of the lighthouse at the west end of the pier which guides the shipping. The steam pipes from the boilers are 4 in. in diameter, to supply the steam winches, having faced flanges and red lead at the joints, and brass wire gauze. From these 4-in. main steam pipes there is a 2-in. steam pipe leading off to each of the six winches, and 1-in. steam pipes to actuate the swivelling cylinders, with stop valves close to the main steam pipe. All the steam pipes are covered with canvas and composition. The exhaust steam pipe from the winches and swivelling cylinders are gathered up into a main pipe 4 in. in diameter, running under the floor of the lower deck, inclined to a centre cylinder at the west end of the pier, where it descends as a 3-in. diameter pipe into a condenser sunk into the river below the low-water line. The condenser is an iron vessel 2 ft. 6 in. diameter and 3 feet high, traversed by 156 tubes, 1½-in. diameter outside, attached to one of the pier cylinders. The condenser permits a circulation of the river water through the same. The exhaust pipe enters among the tubes. The condensed water is raised by a lifting pump 2½-in. in diameter, worked by a donkey pump, into a tank 4 ft. by 2 ft. 6 in. by 2 ft. 6 in.—placed between the boilers as a reservoir to feed the same—by feed pumps worked by the before mentioned donkey pump.

The steam cranes, like the hydraulic cranes at the east end of the pier, lift up the iron skips or buckets of coal from the steam colliers alongside of the pier, containing about 13 cwt. of coal each, fitted with wheels on the bottom, so that they can easily traverse the holds of the vessels, and have bows and catches upon the top. There are small portable platforms, of a height to suit the coal wagons, upon the upper deck of the pier, where the men stand to operate and tip the coal buckets into the train wagons.

The steam cranes at the west end of the pier have, as before stated, been in constant use, day and night, since 1870, and have proved a formidable rival to the more modern hydraulic machinery at the west end of the pier since the completion of the latter. Their economy of fuel, great expedition in unloading the coal skips, and reasonable wear and tear, seem to defy the competition of the more expensive, complicated, and necessarily cumbersome hydraulic machinery. The steam machinery acts directly on the load to be lifted with a length of chain to each crane, when fully run out, of 142 feet to the extreme vertical lift of 60 feet from low-water line to top of the coal wagon, whereas the hydraulic machinery with the same lift requires for each crane 300 feet of chain to be set in motion over the numerous sheaves of the lifting rams and cranes. The friction of the work done naturally follows the extra length of chain set in motion to lift the load; hence the fuel, steam, and wear and tear necessary to perform the same work by the hydraulic machinery is greater than with the steam cranes. These latter only want a few modifications and improvements in the details, the parts being made of a bolder, larger, and stronger type, and they would then form the most simple, expeditious, and economical type of plant for unloading material from ships alongside piers with either great or small lifts. With the winches there are no long water-pressure pipes, pumps, accumulators, complicated valve arrangements, heavy lifting rams, with numerous sheaves cutting and carving into the lifting chains, liability to stoppage and breakage of pipes in frosty weather, and long rapidly revolving chains, to call for an excessive power, noise, and probably more wear and tear in the long run.

The port of Beckton was primarily and necessarily laid out on a large scale, and the details of the works had to be arranged for a large reserve of

accommodation for future wants. The tonnage growth from year to year has not hitherto been less than about 25 per cent., on account of the increased manufacture of gas at this station through the closing of the gas works in London, the natural increase of gas wanted by the metropolis, and also for the added import and export of materials and products connected with the building operations and the manufacture of products at Beckton. The import and export trade at Beckton rivals that of a tolerably busy shipping port giving trade to a large district of country like Hartlepools, its total annual imports reaching nearly a million tons, and its exports upward of 300,000 tons; although the actual cost of the works of the port proper, up to the present time, is not one-tenth of what has been expended at other ports doing a less trade. The import of coals alone annually reaches to between 500,000 and 600,000 tons, and in 5 years' time this will grow to a million tons.

The original idea, under the Company's Act of 1868, which authorized the creation of Beckton, was to construct a large dock in the interior, on the site of the present retort houses Nos. 1 and 2, with a river wall fronting the Thames, and an entrance lock. With this arrangement there would have been long lines of quays, dispersed and isolated cranes, tedious lines of railway, obstructive turn-tables, and all the belongings of a large dock establishment, with its great waste of site; and besides these obstructions the factory part of the establishment would have been thrown about half a mile further into land, and away from the river front. Fortunately this notion was abandoned at an early date, and it was resolved, with the consent of the Thames Conservancy Board, and by payment of an annual subsidy to the latter, to erect a good, sound, workable pier, with high and low levels, taken out into the river to low-water line. As accompaniments to this central pier, two low-level jetties or piers, each 160 feet long, were constructed with platform levels of 5 feet above Trinity high-water mark (ordinary high water) to the east and west of the Company's river frontage, and running out at right angles to the face of the river wall. With these port arrangements the river foreshore in front of the Beckton site now exhibits two dock areas, east and west of the large high-level pier, for the accommodation of the large fleet of barges—sometime 100 in number—lying there engaged in the transport of coke, residual products, and building materials, to feed the low-level traffic of the establishment.

There are two transport systems or lines of communication at Beckton—the high-level and the low-level routes running through the works. The former, or the high-level route, coming away from the river pier on a short incline of 1 foot in each 100 with a double railway, leads the coal direct into the several retort houses. After leaving the pier abutment at the river wall front, the double line of railway goes straight and level through the entire system of the works, between the double row of retort houses, to the western end of the establishment. Diverging from this double line there are four single lines of railway, right and left, one line to each side of and through each retort house; with facilities for dropping the coals in front of the line of retorts, at a level of from 12 to 14 feet above the coal stages. This high level is 23 ft. 8 in. above Trinity high-water mark, which latter is the low level of the several coke holes, and the formation of the ground or low-level lines throughout the Beckton works.

Between Nos. 7 and 8, and 9 and 10 retort houses there occur crossover, connecting, or scissors lines, to form second communications from the double trunk railway along the centre to the branch lines through the houses, so that in case of block to any one or more of the lines the several retort houses can be fed from the rear, as well as the front entrances. By these contrivances there are two strings to the bow, and alternatives for working the traffic. The trains of coal wagons can thus return to the pier either by the central railway or by means of one of the four single lines of railway through the retort houses, to avoid any obstruction which may at any time ensue, by breakdowns, on the lines.

The high-level railway system is being carried on farther and farther westward, from time to time, as the works grow and extend. The railway lines will ultimately pass through an end pair of curved retort houses at the western end of the system, and descend by an incline of 1 in 25 to the low-level railway system, and thence form a permanent connection with the Great Eastern Railway and with the world outside. At present the high-level railways stop with dead ends at Nos. 11 and 12 retort houses; but at this point a side or parallel single line on an inclined viaduct of 1 in 25 connects the high and low levels together. There is at present at the river end of the viaducts also a temporary inclined viaduct of 1 in 16, which for some years has done a similar duty to the above. The traffic between the high and low level routes has thus always been interchangeable, and the locomotives and rolling stock have been housed and repaired on the low or ground level.

The high-level system is principally devoted to the delivery into the retort houses of the enormous bulk of coal, common and cannel, consumed upon the works, which now reaches upward of half a million tons yearly; and collaterally it accommodates also the imports and exports of the products works, at the west end of the site, amounting to upward of 100,000 tons annually. The high-level viaducts at Beckton are constructed upon cast iron columns 12 to 15 inches in diameter, supporting a wrought iron girder superstructure. The double viaduct has three columns to each bay, spaced longitudinally at 25-feet centres, and transversely at 12-feet centres, carrying three longitudinal wrought iron girders. On these girders are placed the wrought iron rolled joists, laid transversely at 5-feet centres, upon which are laid the longitudinal timbers and rails, weighing 56 lbs. per yard, of steel and iron.

The single-line viaducts have only two of the above cast iron columns to each bay of 25 feet, with similar wrought iron superstructure, timber, and rails for a single instead of a double line; but there are two main wrought iron girders for the single line, instead of three for the double line.

The high-level or viaduct lines are directed and regulated by a complete system of railway signals, on the improved railway block plan, actuated from a high-level signal-bridge cabin, placed over the pier abutment and river wall; and the switches and points are governed from this central position under one control, like the best devised methods in use at the large railway centres throughout the country, as directed by the Board of Trade. The locomotives work trains of about 16 wagons each, the latter weighing when full about 7 tons each, carrying between 4 and 5 tons of coal net. The wheel-base of these wagons being only 3 ft. 6 in. in length, they run with facility round the sharp curves of 150 feet and 115 feet radii occuring at certain points on the viaducts and pier. The train of 16 wagons is led into the retort houses in front of the retort benches, and shot through a horizontal trap door in the floor of the wagon (operated by a side lever from the railway floor) on to the coal stages, between the lines of rail. The trains are worked by locomotives with cylinders 10 in. in diameter and 18-in. stroke with two pairs of driving wheels 33 in. in diameter, and a wheel-base of only 5 ft., the latter sufficiently narrow to enable the engine to slip easily round sharp curves.

The weight of each locomotive when light is 12½ tons, and with fuel and water 14 tons. The traction power of these locomotives, with their small wheels, is considerable; and they usually take three 10-ton railway wagons up the temporary incline of 1 in 16, with a sharp run to start on the low level. This is equal to a net load of 50 tons exclusive of the locomotive, or 64 tons in all, including everything.

It may be mentioned here, to illustrate the subject the more fully, that one of these locomotives has a tractive power—on the level of 247 tons; on an incline of 1 in 300, of 142 tons; on an incline of 1 in 200, of 115 tons; and on an incline of 1 in 100, of about 65 tons—exclusive of the locomotive load itself, and with a full steaming effect in the boiler of about 120 lbs. on the square inch. But where the locomotive can command a level run of 200 or 300 yards previous to rising the incline with its load, and provided the incline be a short one, then these loads can be much increased, as is shown by the daily working of the 1 in 16 temporary incline at Beckton.

The low-level railway system at Beckton, which is mostly used for the coke and miscellaneous traffic of the works, starts from the river quay and low-level jetties previously described, and by a number of single-line railways, as shown upon the plan, compasses the whole of the ground-level business of the establishment. All low-level lines are at Trinity high-water mark, or high-water level of the Thames, except where they approach the river front, where the level mounts 5 feet higher; and they are shown by dotted lines on the general plan in juxtaposition to the high-level railways, which are denoted by strong lines. These low-level lines enter all the coke holes of the retort houses, go into the purifying houses, lime and oxide stores, round the external purifiers, into the workshops and locomotive house, westward to and surround the products works, make a good junction with the high-level viaducts at two points, with the general railway system of the Great Eastern Railway at the Beckton passenger and general railway station, and thence with the traffic of the entire country. The branch line of railway from Beckton to the Victoria Docks Custom House Station, about two miles in length, was made by The Gaslight and Coke Company under an Act of Parliament, obtained in 1871, specially for the Beckton traffic; and which Act turned the Gas Company into a Railway Company.

The railway gauge at Beckton is the usual narrow gauge of the country, 4 ft. 8½ in., and the rails used are both steel and wrought iron, weighing 56 and 60 lbs. per yard of rail. The curves on the low-level lines are even sharper than those used on the viaducts, from sheer necessity and economy, turning occasionally round the end of a building at right angles with a radius of 60, 70, and 100 feet; and they take the ordinary 10-ton railway wagons into the coke holes and several buildings about the works. The secret of working these sharp curves with the usual railway rolling stock is that the outer rail to each curve is superelevated at least 4 inches wherever practicable, and the gauge of the railway is laid full—say to 4 ft. 8½ in. net, as is usual on railways. The sharp curves on the viaducts are guarded by a check rail next the inner rail, but with the low-level lines the rails are left

unchecked, the free gauge and superelevation of the outer rail before mentioned being sufficient to keep the wagons safely on the roads at low speeds. The coke wagons which work on the low level carry about a chaldron of coke, and have a very short wheel-base; being constructed as side-tip wagons, to facilitate the side loading into the barges at the quay wall, and without being removed from the straight line of rail.

All the loading and unloading of the quay wall traffic, excepting coke, is performed by the ordinary portable cranes which run on the lines of rail parallel to the river. It comprises large imports of chalk for burning into lime, at the kilns upon the works, ballast, building materials of all kinds for the extensions of the works, and articles for the general use of the undertaking, as well as exports of the different products made upon the works.

Improved Street Lighting at Westminster

The full particulars which we were enabled to afford our readers last week in regard to the lighting by Mr. Wm. Sugg, for the Chartered Gas Company, of Parliament street and Whitehall, would seem to have excited considerable interest in various parts of the country, and during the week several communications have reached us, which certainly tend to show that this most important experiment has engaged a very large share of the attention of those who are responsible for our public lighting. We are afraid that it is quite beyond our power to satisfy all our correspondents. Time alone can settle some of the points raised. But we are able to furnish certain of the particulars which have been asked of us.

A great deal of curiosity appears to have been aroused in regard to the form of lamp used, and, having put ourselves in communication with Mr. Sugg, he has very kindly afforded us every possible information, which we here reproduce.

The Whitehall lamps, which are of an entirely new construction, have been especially designed by Mr. Sugg for that important thoroughfare. The form of the lantern is circular, and it has only four panes, thus diminishing the cost of maintenance. The ventilator, which also serves as a reflector, is made of very hard white porcelain, specially manufactured for these lamps. Around the centre reflector is an anulis of flat white glass in three pieces, fixed by a simple arrangement to enable replacing when necessary and cleaning with facility.

The ventilation, which Mr. Sugg has secured by two patents, is on an improved principle, and consists in supplying air to the burner slightly warmed by passing over the reflector previous to feeding the flames; the inward rush of air induced by the powerful upcast draught being balanced by a small quantity of air admitted through the perforation at wide intervals along the ribs of the lantern. The ribs are very strong and light, and of peculiar construction, and were used by Mr. Sugg in his original lanterns in Waterloo place and Queen Victoria street. One of the four panes forms the door, hinged at the top, and secured at the bottom by means of an improved bolt catch, first introduced by Mr. Sugg for the lamps used at the Beckton Works pier of the Gas Light and Coke Company, and also on Ryde Pier, Isle of Wight, where they are exposed to severe gales.

Mr. Sugg considers it most important that the refuges should be powerfully lighted, so that drivers can see the foot passengers waiting or about to cross the road; and it is Mr. Sugg's contention that his are the only lamps which effect this purpose; they are also so constructed and the reflectors so arranged as to render them shadowless.

The Westminster pattern lantern has been fixed on refuges opposite the Treasury, and are made to throw a powerful light on and round about the refuge, which they do in a most brilliant manner. In respect of ventilation the theory of this lamp is the same as in the case of the Whitehall. They only differ in design at the top, which in the Westminster lamp is semi-transparent, and the reflector more concave; hence the greater concentration of light on the refuge. Each of the Whitehall lamps is fitted with combination burners, consisting of one central flame, and three others fixed round it. Each flame is produced from one of Mr. Sugg's latest improved circular slit, hollow top, flat-flame burners made of steatite—a substance which is extremely hard, and is not affected by heat or damp, and will last unimpaired for many years.

These burners, being constructed in sprays, may be provided with an independent central supply and governor, so that after midnight, if required, they might be turned out, leaving the centre one burning. The burners are specially made for the lamps employed for the purposes of this experiment, at the Vincent Works (which we believe is the only manufactory in England for steatite burners), and are constructed to suit the quality of the gas consumed by them. We are told that the original hollow top steatite burner, of which these are the latest developments, was invented by Mr. Sugg in 1868, but was not patented, our informant adding that "in consequence of its excellence as a burner, it has been adopted all over the world."

The two latest improvements are, viz., Cutting the slit in a circular form, "in section," by means of a tool invented by Mr. Sugg for the purpose; and the flange or table-top around the base of the slit, which produces a rigid flame without destroying in any degree the luminosity of the gas. Both of these improvements have been secured by letters patents. The perfection of flame and results per cubic foot of gas consumed, Mr. Sugg claims, show his burners to be superior to any other of the flat-flame burners. Each combination burner is provided with a new patent governor, also of Mr. Sugg's invention. The governor is fitted with a lining of white metal and a steatite float, which are both unaffected by the action of the gas, and in consequence of their perfect regularity in governing, have received the highest award in the Glasgow Exhibition, and expression of great satisfaction by eminent engineers.—*Metropolitan.*

Building a House on a Sand Hill.

Mr. J. J. de Kinder recently presented the following communication at a regular meeting of the Enginers' Club of Philadelphia:

As I am not aware that it has ever before been attempted in the United States to build a house on the very top of a lofty sand hill, exposed to all winds and weather, while simply depending upon, or rather by simply making the loose sand the agent to keep it firmly secured in its seat, I think a few words upon the construction of a signal station which I have just finished for the Maritime Exchange of this city, on top of the highest sand hill of Cape Henlopen, may be of interest to some.

The signal station mentioned will serve to report the arrival at and departure from the Breakwater of all passing vessels, to the Philadelphia Maritime Exchange by means of the Western Union Telegraph lines, which connect it with this city.

In the first place, it was necessary that the observer stationed in the building should have a clear and unobstructed view of the seaward horizon from south to north—that is, seaward of the coast line.

To obtain this it was necessary to erect the buiding on top of a hill which rises some 80 feet above the level of the sea.

But the building thus necessarily becomes exposed to every gale that sweeps that part of our coast, while it is absolutely required that it shall stand firmly planted in such a way that even a hurricane shall not shake it or make it tremble, as that would effect the sight of the telescope in the observatory.

The usual mode of securing is by building a foundation of screw piles or of heavy timbers sunk into the sand; the latter mode, has this disadvantage, that if the wind shifts the sand away from around the foundation, it becomes undermined, and its effect is thus destroyed.

In order to be independent of all this, I designed what I consider a cheap and, at the same time, an effective anchorage for the building in the following manner.

The building is of wood entirely; it has a cellar, above which are two rooms, one above the other, and the whole surmounted by the observatory proper.

First, the ground sill is a square of 20 feet, made of yellow pine sticks, mortised together and pinned with stout trunnels.

The sill of the observatory is made likewise of heavy timbers, 12 feet long. The two sills are joined together by four stout yellow pine corner posts, which in turn are mortised into both sills. The posts are 26 feet in length. Five feet above the lower sill is the sill which supports the floor of the first room.

Ten feet above this is the sill which supports the upper room.

Both these sills again are mortised into the corner posts.

This structure is sheathed outside with German siding, inside with rough boards covered with felt, and again by tongued and grooved yellow pine boards.

The observatory proper, octagon in shape, is securely mortised into the top sill, and is covered with a corrugated iron roof, conical in shape.

The cellar is floored with 3-inch wood, and boarded all around on the inside of the posts.

I first dug a pit in the sand, about 6 feet deep and fully 20 feet wide on the bottom; I then laid the ground or cellar sill on this bottom, and built the structure; thus the whole depth of the cellar is sunk below the top of the hill, or the level of the sand. I then filled the cellar up solid with sand, and packed it solid all around the outside also; consequently the building is anchored in its place by the load in the cellar, some 100 tons in weight.

I carried three heavy joists (part of the joists which carry the floor) through on one side of the building, and on these the kitchen was built, so that this is also independent of the sand under it.

Since the construction of the station we have had some very severe blows, yet there is no more tremble in the building than if built of stone on a rock.

A few feet from the building stands a signal post or mast, 100 feet high,

which carries a 5 foot ball of rattan covered with canvas; the ball is made to slide on the mast, and is used to answer signals from vessels by raising and dropping it. As it would, in my opinion, be a rather dangerous thing to simply place the mast in the sand—no matter how deep—I sank a well into the sand hill.

This well is made of pine, 20 feet deep and 8 feet square. The mast is placed in the centre of the well and is braced, from the corners of the pine box, by some 20 stout braces, and the well afterward filled and tightly packed with sand inside and outside, so that, like the house, to blow it over would necessitate the moving of a tremendous weight of sand with it.

Illumination by Means of Compressed Gas.

At a Meeting of the Society of Engineers, held on Monday, April 4, 1881, in the Society's Hall, Victoria street, Westminster, Mr. Charles Horsley, President, in the chair, a paper was read by Mr. Perry F. Nursey, on Illumination by Means of Compressed Gas.

The author first referred to the necessity for improvement in railway carriage lighting, which for the most part was still effected by means of miserable oil lamps. Coal gas had to a limited extent replaced oil, but its use was attended with many disadvantages. The use of gas under pressure had long since been attempted, but the difficulties of compression, condensation, and regulation had told against it. These difficulties having been overcome, the use of compressed gas for railway carriage lighting was now extending. The author stated that during the past two or three years he had had the opportunity of inspecting the working of three different systems of railway carriage lighting by means of compressed gas. The first was that of Mr. Wm. Sugg and Mr. F. W. Clark; the second that of Mr. Geo. Bower; and the third that of Mr. Julius Pintsch. In the first and second systems ordinary coal gas, enriched by means of hydrocarbon vapors, was used, whilst in the third oil gas was employed. The author also observed that Mr. Sugg had also recently perfected a system of using cannel coal gas under pressure.

In the Sugg and Clark process it was explained that ordinary coal gas was enriched by the addition of hydrocarbon vapors under the influence of heat by means of special apparatus. The enriched gas is stored for use under a pressure of about 120 lbs. per square inch, and is delivered, still under pressure, into receivers placed on the top of the carriage. A governor or regulator is placed between the receivers and the burners in the carriage, so that the gas is consumed at the proper reduced pressure.

The author stated that he had inspected the arrangements for carrying out the practical application of this principle by Mr. T. C. Hersey on the part of the Gas Light and Coke Company in connection with the Great Northern Railway at King's Cross. He was also afforded the opportunity of inspecting the light in use in one of the Great Northern carriages which had been fitted up by Mr. Sugg, the results being very satisfactory. The experiment was made by permission of Mr. Oakley, the superintendent of the Great Northern Railway, and, so far as it went, it succeeded. Mr. Oakley, however, desired to try gas made from cannel coal, which does not require enriching, and that experiment was now being carried out at the Victoria Station of the London, Chatham, and Dover Railway. There, the author stated, the Gas Light and Coke Company had erected compressing apparatus for the supply of trains with cannel gas, the enriching works at King's Cross remaining in abeyance pending the experiment. A train of eleven Great Northern carriages had been fitted up for burning the compressed cannel gas, and was now running.

The author stated that the Sugg and Clark process of enriching ordinary coal gas had been improved by Mr. Sugg, and the new apparatus had been erected at Swindon for the Great Western Railway Company to light the carriages on that line with the ordinary gas of the company compressed and enriched. The apparatus at Swindon was then described by the author, as also the arrangements for lighting the carriages.

The author then observed that the subject of improved railway carriage lighting had for some time past had the attention of Mr. George Bower, and he had recently perfected a system of lighting by means of enriched compressed gas, which was now under trial. The system consists in storing ordinary coal gas at a pressure of about 150 lbs. per square inch in wrought iron cylinders, placed on the top of the carriage. From the cylinders the gas passes to a regulator, which is the invention of Mr. A. S. Bower, and in which its pressure is regulated as it passes to the lamps, so that, as in the previous case, although the pressure in the store cylinders becomes reduced as the gas is used, it is maintained constant at the burners. Before reaching the burners, however, the gas is submitted to a carburetting process, under the influence of heat, by which it is enriched and its illuminating power increased. By this means a light is produced, of the excellence of which the author stated he had recently had an opportunity of judging from a run in a Great Northern carriage thus illuminated. There are arrangements for turning down all the lights in the carriage simultaneously from the outside when not wanted, a small flash jet only being left during the day and when there are no tunnels to pass through. These arrangements were also provided in Sugg's carriage.

With regard to cost, it was stated to be 6s. 8d. per 1,000 cubic feet of gas, including the cost of compressing and carburetting. The carriage fitted on Mr. Bowers' principle was stated to have been taken over by the Great Northern Railway Company, and placed for service on the line between London and Peterborough.

Pintsch's system of railway carriage lighting by means of compressed oil gas was next described. The principle was stated to consist in distilling the refuse of shale oil or other similar matter, and in storing and using under considerable pressure the gas produced from it. The gas is of high illuminating power, and was stated to be of a thoroughly permanent character. The gas was produced at works in each case conveniently situated with regard to the railway adopting the system. The works vary in size according to requirement, but the general arrangement, and most of the details, are similar in most cases, subject only to variations necessitated by varying local conditions.

The author stated that he had visited several of the works, and proceeded to describe those of the Metropolitan Railway at Hammersmith. The gas is distilled from shale oil refuse in specially constructed retorts, and after passing through the processes of washing and purifying is stored under a pressure of 150 lbs. per square inch in store-holders. From the store-holders the gas is conducted to filling posts, and supplied to the carriages by means of coupling hose. The gas is carried at a pressure of 90 lbs. per square inch in wrought iron cylindrical receivers fixed under the carriages, and passes on its way to the burners through a regulator, by which the pressure is reduced and maintained constant at the point of consumption. As in the other cases, there are arrangements for turning the lights down simultaneously when not required. The cost was stated to be ½d. per light per hour. The author said he had occasionally traveled in carriages lighted on Pintsch's system on various lines, and had always found a bright, steady, and efficient light.

The author observed that the system had been in use in Germany, and on the Continent generally, for about nine years, and in England for about five years. On the Continent it was in use on 63 lines of railway, 45 gas works being in operation for supplying the gas for no fewer than 5,500 carriages. In England the system was in use on five lines, namely, the Great Eastern, the South-Eastern, the South-Western, the Metropolitan, and the Metropolitan District railways. There were seven gas works in operation, and two more in course of construction in connection with those lines. The number of carriages fitted and running was 700, whilst 300 more were in course of being fitted, thus testifying to the value and practical advance of the system.

The author next described the application of Pintsch's system to the lighting of buoys, in which direction it had proved very successful. The buoys are made of wrought iron, and contain a supply of the gas under pressure. The lamp is mounted on the top, and will burn for six, nine, or twelve weeks, according to size with one charge of gas. The sizes are 7 feet, 8 feet, and 9 feet in diameter respectively. There are altogether five of these buoys in operation, and six more in course of construction. The Corporation of the Trinity House have adopted the system, and have sent in a requisition to the Board of Trade for funds to erect a gas works on Pintsch's system at the Trinity wharf for the special service of illuminated buoys. The Clyde Lighthouse Trustees have also adopted these buoys, and a gas works is now in course of construction at Port Glasgow, with a view of carrying out the system. The Clyde Trustees also contemplate replacing one of their old lightships by one on Pintsch's principle, which will not require a resident attendant.

Mr. Nursey finally described the application of Pintsch's system to the interior lighting of steamers, as practiced both in England and America, and noticed the circumstance that the South-Western Railway Company contemplated lighting some of their isolated roadside stations by the same means. His conclusions were that the systems first described could at present only be regarded in the light of experiments, whilst Pintsch's system was an established practical fact. The paper was illustrated by diagrams and models, Pintsch's light being exhibited burning during the evening.—London *Iron*.

Hydrobromic Acid as a Reagent for Copper.—A drop of the solution in question is placed in a watch-glass, a drop of hydrobromic acid is added, and the mixture evaporated at a gentle heat. When it is reduced to the bulk of one drop a rose-red coloration appears, three or four times more intense than that produced by potassium ferrocyanide. In this manner 1-1000th milligrm. copper may be detected.—*Chem. News*.

Peril in the Electric Light Wires.

A TELEPHONE DEMOLISHED.—BUILDINGS THUS LIGHTED RATED SPECIALLY HAZARDOUS.

At a recent meeting of the New York Board of Fire Insurance Underwriters, the danger arising from the use of electric lights came up for discussion. The matter had been investigated on account of an accident a short time ago in a jewelry store in Maiden Lane. A telephone is in this store, and the other day, when a man was on the roof running an electric light wire across, it came in contact with the telephone wire, and a flash passed down to the telephone box, melting the annunciator and other metallic parts, and burning the box. The shock loosened a considerable extent of plaster.

City Electrician Smith said that the shock which demolished the telephone in the jeweller's store must, he thought, have been very powerful, and had anyone been at the telephone he might have been killed; or if the flame had passed near light goods there might have been a conflagration. The wires of the electric light ought to be thoroughly insulated.

Superintendent Harrison, of the New York Board of Fire Insurance Underwriters, said that the Board would ask the proper authorities to see that the electric wires were properly insulated. Owing to the rapid introduction of the electric light, and the many new wires that were being run over the city houses, the danger, he said, was constantly increasing. In the meantime buildings using the electric light would be rated as "specially hazardous," unless the insulation of the wires was approved.

A. A. Hayes, Jr., of the Brush Electric Lighting Company, has informed the Board that the wires of that company were already insulated while the matter was under discussion; and since the action of the Board, the other companies have been experimenting in regard to the best method of insulation.—*N. Y. Sun*, May 6.

Electric Illumination for Mines.

Some further steps of progress toward obtaining the electric light in such a form as to make it available for the illumination of mines appear to have been made by inventors whose systems have been exhibited during the past week. The method of subdivision devised by Mr. J. Banting Rogers, of St. Clement's House, Lombard street, is at once simple and ingenious, and should the results obtained on a large scale correspond with those in the experimental trial, the introduction of the system as a substitute for other means of lighting collieries would present no difficulty whatever. At present, however, nothing can be said as to the commercial value of the invention, as the construction of the distributor is kept secret, and the specification of the patent which protects it is not yet published. But there is one fact beyond question: Mr. Rogers produced a visible current in between 30 and 40 Geissler tubes from one bichromate battery—a bastard Bunsen—connected to a small Ruhmkorff induction coil; these tubes, moreover, were on five or six circuits all supplied from the one current, yet so completely independent of each other that the breaking of one or more of the circuits did not produce any sensible effect on the others. The distributor probably consists of a series of subsidiary reduction coils, since both the hand and a very rough galvanometer (the only one provided) indicated rather an increase than otherwise of current after subdivision. The conductors, positive and negative, are led from the battery and coil to a small box not larger than 4 in. by 3 in., and from this four distinct currents are led. As each of these can be again subdivided and so on, it will readily be understood that there is a wide scope for extension. The inventor claims that he can divide and subdivide the electric current so that for lighting purposes it can be made available for the smallest room, and thoroughly controllable. No part can get out of order, and when used it becomes certainly the best governor yet introduced for controlling the subtle power of electricity. Each apparatus is in itself an accumulator, governor, and a subdivider. He can utilize the current to any extent, and as easily give forth a number of lights as he can one. It is only a question of the electric force or fluid that any magneto machine will produce, being passed through his apparatus to be divided and subdivided to any extent required.

Another invention, which appears to be a modification of the Regnier or the André light, has also been exhibited this week at the offices of the Electric Light Agency, in Queen Victoria street. The light is produced by heating to incandescence of the end of a thin carbon rod which forms one electrode, and which is continuously fed through special and simple contact jaws against a fixed cylinder of copper forming the other electrode. The light emanates from the short length of carbon between the clamping jaws and the copper cylinder, but chiefly at that part near the metal where the rod becomes pointed by the action of the current, and where it is, therefore, more intensely heated. In addition to the light produced by the incandescence of the carbon there is also the glow or flame which proceeds from the surface of the carbon to the copper electrode, similar to an arc light. The Joel light thus takes an intermediate position between the purely incandescent system of Edison and the arc lamp of Serrin and others. The lamp in which the electrodes and the mechanism are inclosed is externally precisely similar to some gas lamps, being fitted with gaselier suspensions and terminating in a ground or opalescent glass globe. A switch or tap is placed in each room, and the light is turned on and off at will. There are automatic safety arrangements, so that before the lamp can be opened when burning the electric current is shut off, and this also occurs when the carbon has been consumed, all liability of accident being thus avoided. The whole system, in fact, as far as the arrangement of the lamp and its accessories are concerned, has been approximated as much as possible to that of gas lighting. The light is very steady, of a pure white color, and of good power.—London *Mining Journal.*

California Petroleum.

The petroleum interests of California are much greater than most people suppose. The considerable region of southern California, which gives great promise of developing into an oil-producing section of vast productiveness, invites the attention of the public. It is a matter of deep interest to know whether the oil belt is to be relied on as an important accessory of or successor to the Pennsylvania field. It is of interest not only to California, but to all parts of the country. Citizens of Los Angeles, Ventura, and Santa Barbara counties are numerously signing a petition to Clarence King, Director of the Geological Survey, directing his attention to the petroleum region in the counties named, and to the work of development prosecuted there since 1865. They say:

We represent that outcroppings of petroleum are found along the line of a belt of shale, about 80 miles in length, extending from the San Fernando district, in Los Angeles county, through the "Sespe," "Santa Paula," "Ojai," and "Sulphur Mountain" districts, in Ventura county, and the "Carpenteria" and "Santa Barbara" districts, and terminating in the Pacific Ocean off the asphaltum mines at "Goleta," in Santa Barbara county; that the remarkable and innumerable exudations of oil, and other indications which occur along this belt of shale, have induced many of our citizens and the citizens of other States to engage in the work of prospecting and developing this region for the production of petroleum; that such work has been prosecuted without the aid or guidance of any thorough or reliable scientific investigation, and has involved the expenditure of an immense amount of labor and a million dollars in money, with practical results which are generally unsatisfactory and discouraging, which will probably be of sufficient aid to the geologist, after a survey of the region, in arriving at conclusions relative to the productiveness of the region which will be of most important practical use.

That the uncertainties and risks which attend the work of development in this region, as compared to those which are incident to such work in Pennsylvania, owing to the difficulty to comprehend its geological construction and features, and to the peculiar difficulties experienced in boring wells, are excessive.

The practical operators and capitalists familiar with the subject, unite in the opinion that the results of their work strongly tend to prove that large quantities of petroleum of good quality exist, and probably can be obtained in this region, but the uncertainties and risks referred to will discourage them from continuing or enlarging their operations until they can have better guidance than their experience supplies.

Petroleum exists in many parts of this State, and the hope is indulged that in time not only our home market in the Pacific States and Territories, but Australia, China, Japan, British Columbia, Mexico, Central America, and South American countries on the Pacific seaboard, will be all supplied with the product of these oil regions; but at present the petroleum district which we have mentioned and described, owing to the frequent exposure of geological structure, and to the superior importance of the developments already made, and its proximity to the ocean, which offers cheap transportation for the product, presents more attractive features to the capitalists, and offers more incentives for practical operations, and more data for scientific inquiry, than any other.

Wherefore, as the material interests of the country, which your survey is so well designed to develop, would be greatly promoted by the successful solution of the problem which is here suggested, we respectfully ask that a geological survey be made of the oil belt above described, under your direction and at the public expense, to determine the general character and extent of the oil-bearing rocks of that region; and in some district, which to you may seem most important and promising of desired results, to determine the legal stratagraphy, sufficiently accurate to enable the prospecting and development of the territory to be intelligently resumed.—*Mining and Sci. Press.*

The Future of the British Association of Gas Managers.

The London *Journal of Gas Lighting*, of April 19th, in its editorial remarks on the above subject, contains the following :

"The time has arrived when managers of gas works, and members of the gas engineering profession throughout the kingdom, begin to feel themselves within measurable distance of the annual gathering of the members of the British Association of Gas Managers. The meeting of the current year may be expected to be marked with unusual features of interest and importance. The external circumstances of the assemblage will, probably, be notable in many respects ; but, in addition and superior to these considerations, however calculated to enhance the importance of the occasion, there will, we anticipate, be grave questions of internal organization submitted to the members of the Association then present together, the solution of which will necessarily constitute an event in the history of the society. Before proceeding to indicate the character and scope of the proposals for the reform of the constitution of the Association which will probably be made at Birmingham, it will be advisable to review briefly some of the causes which have led to a determination on the part of the most prominent members of the Association to undertake this difficult and somewhat delicate enterprise.

"The British Association of Gas Managers, when it was first founded, and for some time afterwards, occupied a position and supplied a want which would have otherwise remained painfully obvious. From the beginning of its existence it had one great duty to perform, which was, indeed, indicated by its very title. It was to be the *Association* of Gas Managers—that is to say, it was founded to promote the intercourse and fellowship of a class of men who, by the nature of their calling, are thrown almost as completely upon their own resources as are master mariners. The social and professional isolation of men who, so far from being given to an habitually contemplative life, are constantly exercised in command and responsible action, is an evil of considerable magnitude. It is commonly seen how such men grow opinionated, domineering, and objectionable to their equals ; and how, eventually, their own minds become narrowed, and their professional faculties grow hopelessly fossilized. The evil of almost continuous isolation is, of course, inseparable from the life of a gas manager ; but its worst effects can be and are obviated by mutual association for the periodic exchange of ideas, between those who, on such occasions, are enabled to find their own level among their professional brethren. It is difficult in these days to appreciate the state of the members of the gas engineering profession, with reference to each other, at the time when the British Association of Gas Managers was founded, or for some time anterior to that period. Now-a-days, if we find a gas man so wrapt up in his own self-importance as to stand sullenly aloof from his follows, or to shut the gates of his little world in their faces, we regard him as a kind of geological specimen who has outlived his era ; and we console ourselves for his selfishness with the thought that even if he would speak he could not tell us anything worth listening to, while his works, if displayed, would probably be useful merely as examples to be avoided. We have become accustomed to a freedom of communication, and readiness of one gas manager to help or advise a brother in need, which has so grown into a general custom, that it is difficult to believe there was a time when the very reverse was the almost universal practice. For this altered state of things—for this letting of daylight into gas works, and general spread of good fellowship amongst their managers, thanks are due in no sparing degree to the Association which has now pursued for eighteen years its career of consolidating, and at the same time widening the scope of the profession actively followed by the majority of its members. It might be permissible to enlarge somewhat upon the benefits which this advent of the more friendly spirit, and the more liberal principle, has conferred not only upon the profession and the interests confided to the charge of the members thereof, but upon the community at large. We will, however, be content with expressing the conviction that they are great, and extend into unexpected ramifications. In measuring the past work of the Association, this great division of it, which is so complete that it is almost in danger of being overlooked, must never be forgotten.

Circulation of Air in the St. Gotthard Tunnel.

M. Stampf has been giving careful attention to the variations in the air currents between the two openings at Göschenen and Airolo. He finds two principal causes to be operative in these changes : First, the southern opening is 30 metres (32·809 yards) higher than the northern, which represents a pressure equivalent to that of a column of air 36 metres (39·371 yds.) high at the subterranean temperature ; second, the difference of barometric pressures upon the two declivities of the mountain. If the external temperature was the same at each side, and if there were no modifications of velocity due to the heating and expansion of the air or the friction against the walls—the draft would always be southward.

Meteorological observations are regularly taken, both at Airolo and Göschenen, to determine the elements which are required to know, monthly or annually, the number of days for which a given direction of current or an absolute calm may be expected in the interior of the tunnel.—*Journal of Franklin Institute.*

[Correspondence London Daily Times.]

Gas versus Electricity.

To the Editor of the *Times :*

Sir—While the public mind is occupied considering the rival systems of illumination, I venture to offer the following points for the consideration of your large circle of readers :

The introduction of the electric light has up to the present been of assistance to gas lighting, inasmuch as it has enforced the demand for a generally more intensive illumination. Even if the electric light were now to pass out of sight, the demand for better and more intensive illumination would survive. Since the first foolish panic in gas stock our system of gas lighting has been greatly improved, as is evidenced in the burners now in use in this city of Bray, Sugg, and others, and in Paris of the gas burner known as the "Paris light." These improved gas burners necessitate, of course, a larger, though more economical consumption of gas, and so far have increased the quantity taken from the gas companies.

With regard to the electric light opinions differ as to its economy and practicability ; but as it is now on its public trial it would not be fair to offer any criticism upon it. This much, however, may be said that in France the system of electric lighting there in use is already waning in presence of the improved and economical gas burners, which even in their intensity retain always the warm glow and tint of sunlight.

The scientific societies in Paris have lately been engaged in making comparative examinations of the different lighting systems. The Société des Ingénieurs Civils, at Paris, issued a pamphlet on the 21st of January last in which the following interesting comparative table is given, showing, as it does, the very great progress made in the direction of gas burners giving more intense light with hitherto unknown economy.

Designation.	Consommation en litres a l'heure. Litres.	Intensite lumineuse en carcels. Carcels.	Consommation par heure et par carcel. Litres.	Effet utile de 1000 litres de gaz. Carcels.
Becs papillons, 1re serie....	100	0.77	129	7.70
Id., 2e serie.....	140	1.10	127	7.85
Id., 3e serie.....	200	1,72	116	8.60
Bec intensif de la rue du Quatre-Septembre	1400	13.00	105à107	9.20
Bec intensif Marini Gœlzer..	800	8.5	95	10.60
Id., id.....	1500	17.00	90	11.30
Id., spheroidal Bengel....	700à750	9à10	75à80	12.80
Id., Ulbrich Messmer (same as Sugg)....	500	7.00	70à75	14.00
Id., id.....	1400	20.00		
Id., id.....	2000	27à28		
Bec Siemens à regenerateur.	300	5à7	45à50	20.00
Id., id	600	13à15	40à45	23.00
Id., id.....	800	20à22	38à40	26.00
Id., id.....	1600	46à48	30à35	29.00

From this table it will be seen that while the ordinary street gas jet (*bec a papillons*, or bat's wing) gives for every 1000 litres of gas but 7.70 units of light, the latest gas burner, that of Mr. Siemens, of Dresden, for the same quantity of gas exactly, gives 29.00 units of light, being an increase from nearly one to four. This shows, therefore, that the quantity of gas formerly used is now made to give four times the former light, or, in other words, gas is in a position four times better to meet competition to-day than it was, and that without disturbing either the organization, plant or monopoly of gas companies.

It must be remembered that the ordinary electric lights are constructed to give a light calculated (British figures) to produce upwards of 1000 candles. On the other hand, regenerative gas burners are now being made to give also 1000 candles light, and that with a consumption of gas which, when used on the old systems, gave only 250 candles' light. This regenerative gas burner combines with its other qualities the whiteness hitherto unknown in gas lights. Without offering a word in depreciation of the electric light, which now makes so much stir among the speculative novelties of modern science, the gas companies may view with perfect composure whatever progress its new-born rival may make, in the confident expectation that, whether in intensity of light or economy of production, they will be able to hold their own, while in the demand for improved illumination they will only find an enlargement of their already enormous production.

I am, Sir, your obedient servant,

H. Lindsay Bucknall, Assoc. Inst. C. E.

8, Victoria Chambers, S.W.

Mr. Sugg on Improved Street Lighting.

The London *Times*, of April 21st, publishes the following letter from Mr. William Sugg under date of April 18th, in relation to this subject—

Sir—In the *Times* of Saturday last there appears a letter signed "F. Nettlefold," which purports to "show that by the use of the electric light (for lighting streets, instead of gas) an immensely increased power of illumination can be secured without any increased expense."

I have carefully read his letter, in order to discover how this was to be done, and have inspected the electric lighting in the city of which he speaks; but I find that, not only does he not show any improvement over gas, but exactly the reverse. In support of his view of the case he refers to what he is pleased to call "the latest efforts of the London gas companies" in Whitehall and Parliament street, and says that this improved lighting "bears no comparison to the illumination afforded by electricity." This is a very wild statement, and, like many others, as baseless as it is wild. Taking Mr. Nettlefold's figures, "the total estimated quantity of light thus afforded (by the gas) in Whitehall and Parliament street is 6,160 candle power." The length of Whitehall and Parliament street lighted by me on my improved system for the Gas Light and Coke Company is about three and one-third times longer than is Bridge street, Blackfriars, measuring from the corner of Fleet street to the refuge opposite the Royal Hotel. The city street is now lighted by electric lamps on the Brush system. Therefore, supposing the West End thoroughfare to be of the same width as the City street, it is clear that, at least, 16 Brush electric lights would be required in Whitehall and Parliament streets to afford an equal amount of illumination with that now given by the five Brush electric lights in Bridge street, Blackfriars.

Each of the Brush electric lights is stated in the *Times* to be equal to 2,000 candles. This multiplied by 16 gives 32,000 candles as the total illuminating power of the electric lights which would be required to light such a thoroughfare. Now, if Mr. Nettlefold's figures are correct, it costs 6s. 8d. per hour (the cost of the gas lighting in Whitehall and Parliament streets) to produce 35,000 candle power of electric light. But I say that the general lighting of Bridge street, Blackfriars, does not equal in volume of light that given in Parliament street and Whitehall, and I feel a strong conviction that the majority of the public who see the two systems in operation will agree with me on this point. Furthermore, the width of Whitehall averages about double that of Bridge street, Blackfriars for a distance of, at least, twice the length of the latter street. This would necessitate the employment of not less than 10 electric lamps, in order to bring up the lighting to the present standard of the city lighting—or 20,000 candles additional. This makes 52,000 candles.

Now, again, taking Mr. Nettlefold's figures for the cost, I find that, to light Whitehall and Parliament streets by electricity to the same degree of illumination as that given in Bridge street, Blackfriars, it would cost nearly double what it now costs for gas with my improved system. But more than this, each end of this important western thoroughfare is lighted to a much greater degree than the rest of the street, and it will be quite impossible to equalise this by means of electricity without still further increasing the number of electric lights over that I have already stated. As witness the effect produced by three Brush electric lamps on the south railings of New Palace Yard compared with that given by two of my 180-candle power gas lamps on the two refuges in Bridge street, assisted by two small 60-candle power lamps on each side of Parliament street.

The total volume of light given by the gas lamps equals 480 spermaceti candles, as against 6,000 candles representing the intensity of the electric lights. So that it may be safely estimated, according to Mr. Nettlefold, that the cost of lighting Whitehall and Parliament streets by Brush electric lamps would be more than double what it now costs to do it by my improved system of gas lighting, and even with this outlay the volume of light in all parts of the street would not, I venture to assert, be equal with that now obtained from gas.

Were it not that I fear to intrude on your valuable space, I would offer some remarks on the rest of Mr. Nettlefold's letter, but I feel that my letter is already sufficiently long.

I have the honor to be, Sir, yours most obediently,

WILLIAM SUGG.

Vincent Works, Vincent Street, S. W., April 18.

The New Eddystone Lighthouse.

The following information concerning the progress of operations at the new Eddystone Lighthouse is taken from the *Architect*—

"The masonry up to the fifty-second course, which is 80 feet above low water mark, has been completed. It is now on a level with that of the light of the old tower; thus the new tower already intercepts the light from the old tower over a very perceptible area, viz., twelve degrees near the reef. This would soon be passed over by a ship, but at five miles distance there would be a mile of darkness on a true south-west course. It was intended in the original specifications to provide for this interception by placing a second light in the new tower at the same level as that in the old tower, so screened as to be visible only within the limit of the dark arc. There was also to have been a temporary bridge from one tower to the other, so that the second staff of light-keepers might have communication between the two towers.

"This, however, is not to be carried out, and the Trinity Corporation have given public notice to mariners that there is such a dark arc, and the cause of it. The fifty-first course, which was laid a few days ago, is a floor course, and completes the fourth apartment above the well. The room just completed is the crane-room, and is provided with two doors besides a window, one facing south and the other north, so that stores may be taken in from either one side or the other, according to the state of the weather. The three rooms below this will be occupied as oil and general store rooms. The room immediately above the crane room was to have been occupied by the white fixed subsidiary light, which is to cover the reef of rocks known as the Hand Deeps.

"The rocks bear from the Eddystone Lighthouse three and a-quarter miles in a direct line between it and Lool Island. At low water there is a depth of four fathoms of water upon them. Although this would be ample for ordinary craft in fair weather, yet in rough weather it may go ill with even a small vessel in the trough of the sea, much less one of a larger class, or, perchance, an ironclad.

"This subsidiary light will only be seen within the area above-named, and when in the vicinity of danger. It is now intended that this subsidiary light shall be placed in a room higher, so changing places with the living-room. These modifications, together with the preparation of the light itself, are being carried on in the yard at Oreston, and afford occupation for the men when they are not able to work at the rock.

"In external appearance the new tower will be a complete alteration from the old both as to height and color, being nearly double as high, and of uniform granite, like the breakwater lighthouse. The light itself is to be a modification of the plan recommended by Sir William Thomson. Instead of a fixed white light, as at present, it will be oscillating. The light will be a white double-flashing half-minute light, showing two successive flashes of about 2½ seconds' duration, divided by an eclipse of about 21 seconds. The light will be visible all round the horizon, but from its more elevated position it will be seen in clear weather 17½ miles, and its field of visibility will overlap that of the Lizard, instead of there being, as now, eight miles of darkness.

"Out of the 2,200 stones, of which the tower will consist, over 1,800 are already in position. At the present rate of progress, therefore, it is probable that next autumn's excursionists will witness the completion of the tower, and mariners are informed by public notice that the new tower will be ready for the exhibition of a light early next March."

Explosions of Coal Gas on Board Ship.

A pamphlet has been issued by the British Board of Trade calling the attention of ship-owners, ship masters, colliery owners, coal brokers, underwriters and others to the conclusions arrived at by the Royal Commissions with regard to the prevention of explosions of coal gas in ships, especially to their fifth recommendation, which is as follows:—"5. That with a view to guard against explosion, free and continuous egress to the open air, independently of the hatchways, should be provided for the explosive gases by means of a system of surface ventilation, which would be effective in all circumstances of weather." Certified masters and officers are especially warned that neglect on their part will, in the event of accident, be brought to the notice of the Wreck Commissioner or of the Court investigating the case. The Board of Trade also give notice that, as vessels laden with coal, insufficiently or improperly ventilated, are dangerous to human life, it is their intention to prosecute those persons who in future send or take, or attempt to send or take, or are parties to sending or taking or attempting to send or take to sea British coal-laden ships which, on account of such insufficient or improper ventilation, are in such unseaworthy state that the life of any person is thereby endangered.

The pamphlet contains condensed reports of inquiries which have been held in cases of explosion of coal gas in ships during the last four years.—*Coal Trade Journal.*

CEMENTING LABELS TO METAL.—For attaching labels to tin and other bright metallic surfaces, first rub the surface with a mixture of muriatic acid and alcohol; then apply the label with a very thin coating of paste, and it will adhere almost as well as on glass.

Twenty-Fifth Annual Report of the St. Catharines Gas Light Company.

The following is the report of the Directors of the St. Catharines and Welland Canal (Canada) Gas Light Company for the year ending March 1st, 1881 :

The amount expended during the year on extension of mains ($183.04), together with the allowance for wear and tear of meters, has been transferred to profit and loss as depreciation of works.

The quantity of gas made was 10,132,800 feet—a decrease of 260,600 feet. Private consumption shows a falling off of 126,600 feet, and the supply to manufactories an increase of 100,700 feet.

The reduced price of gas from that of former years has not led to the increase in the number of consumers that was anticipated, but as rendering of monthly accounts has been strictly adhered to, payments have been made more promptly, and few losses have occurred during the year.

The gross earnings were $24,435.14, and the ordinary expenses $13,811.36, leaving $10,623.78 as the net earnings, out of which two dividends of five per cent. each, or $10,000, have been declared and paid to shareholders in September and March, leaving $19,628.38 at the credit of the profit and loss account.

The accounts and vouchers for the year have had the usual examination, and the Auditor's report thereon is appended to the itemized statement of the working results.

F. J. Timmons, *Secretary.* Thos. R. Merritt, *President.*

Colliery Accidents and Their Causes.

By the great public attention roused and directed to colliery accidents through explosions such as that at Seaham Harbor, a false impression is caused in the minds of the public in regard to the loss of life in and about the coal mines. The popular impression is that the explosions, such as from time to time shock the public mind, are the most fatal of the causes of loss of life in coal mines ; but this is not the case, as may be shown from official returns of the inspectors of mines. It may be stated that for some time we have been deriving the benefits from the Acts on the Inspection of Coal Mines, in addition to direct methods, by the more accurate records that are now obtainable in regard to the extent of the loss of life in mines and the causes ; and the official documents to which reference has been made to enable us to say with some accuracy to what the loss of life is traceable. At the present time it may be of interest to trace this a little in detail, so as to show which of the great causes of colliery accidents is the most fatal. The knowledge of this would do much to remove some of the erroneous suppositions that are made, and would enable the mind to be more readily directed to any possible remedy. It is evident that for this purpose it would be misleading to take the returns for one year, and that, the further the inquiries can be extended back, the more reliable would be the conclusions that may be drawn therefrom.

The returns of the inspectors of mines for the present year furnish tables that extend over nearly thirty years, and dividing these into two decades, and adding those for the incomplete decade, it may be said that we shall obtain a mass of fact which shall be well worth consideration. We may premise that the tables give both the number of accidents by which lives were lost, and also the number of lives lost in each year, and it is evident that the latter is the table which will be the most useful for the purpose named.

It may be added that the chief causes of accident in and about mines are thus classified—fire-damp explosions, "roof and sides falling," accidents in shafts, miscellaneous underground, and miscellaneous on surface. Taking the first and second classes, we give the following as a summary of the teachings of the elaborate tables given by the chief inspector. The number of deaths in the three periods were as under—

Years.	Fire Damp. Explosions.	Roof and Sides falling.
1851 to 1860	2,441	3,767
1861 to 1870	2,267	4,163
1871 to 1879	2,187	4,046
	6,895	11,796

It is clearly shown, then, by this table, that heavy as was the loss of life by fire-damp explosions in the coal mines of the kingdom, the loss of life from falls of roof and sides in the mines far exceeded that heavy loss. And whilst the loss of life from fire-damp explosions has been decreasing during the twenty-nine years covered by the comparison, the reverse is the fact in relation to the more frequent, if singly, smaller accidents. And it may be further said that whilst the loss from these heavy explosions is irregular, and distributed in different degrees in various years amongst the chief coal mining districts of the country, yet the loss of life by roofs and sides falling is constant and general. For instance, last year, there was only one life lost by explosions of fire-damp in Northumberland, Cumberland and Durham ; this year there will be over 160, and it is possible that districts that were heavy sufferers last year may this year be free. But last year, whilst the three counties named were free from that heavy loss of life from fire-damp which has been this year broken in on, they had to record a loss of not less than fifty-one lives from falls in the pits. This constant loss of life is not brought so strikingly to the notice as that of the other, and hence it is overlooked.

Turning now to the other heads, we give the table in the same way, for the same period of twenty-nine years. From the causes named the loss of life at and about the mines was as as under :

Years.	In Shaft.	Miscellaneous Underground.	On Surface.
1851 to 1860	2,119	1,186	505
1861 to 1870	1,505	1,916	775
1871 to 1879	1,264	1,724	810
	4,888	4,826	2,090

It thus appears that there were 4,888 lives lost by accidents in the shafts of the mines, and that the loss of life from this cause has decreased of recent years—a decrease contributed to by the use of "detaching hooks," by which over-winding and other cage accidents have been almost minimized. But the number of miscellaneous underground accidents has increased in these years—swollen as it now is by many fatalities with trams and tubs and on inclined planes. The accidents on the surface have also increased during the last twenty-nine years and no very special cause can be assigned for this increase.

If now we take these totals and give the numbers for the decades, we shall have the following as the loss of life from accidents in and about our coal mines—

Years.	Lives Lost.
1851 to 1860	10,018
1861 to 1870	10,626
1871 to 1879	10,031

It is a fearful loss of life, and at first sight it seems that it is in each decade growing worse. But it must be borne in mind that the truest test is that of the proportion that that loss of life bears to the coal produced and to the number of persons employed. More than double the number of persons are now employed about and in old coal mines that there were 30 years ago, and hence though the number of lives lost is slightly more than it was there is an increase in the comparative safety of the miners, and to a very large extent.

And in regard to the coal extracted for every life lost, there is the same testimony, the only important detailed losses in which the contrary is the case being those incurred by miscellaneous underground and surface causes, It is well, therefore, to bear these facts in mind, for it is evident that a localization of the causes of the accident is needful to insure any preventive. What legislation may be needed it is not now desirable to state ; but it may at least be pointed out that whatever might be done to check the serious loss of life from fatalities such as that at Seaham, yet it is clear that there needs the intelligent increase of supervision below, not only on the part of the employer, but on that especially of the miner. It might be that scientific research and additional legislative enactments might do something to lessen the loss of life from heavy fatalities ; but it needs constant effort and general care to reduce that smaller but ever running stream of fatality which bears away the chief part of our mining population that falls year by year out of the ranks of the workers, and passes on the stream of accident into the Silent Land.—London *Builder.*

Testing Drain Pipes.

A writer in the *Ironmonger*, from long practical experience in testing drain pipes, confidently recommends for that purpose what he terms a "smoke test ;" and which gives evidence as to leaks both to the sight and smell. The materials that he employs are soiled cotton waste and sulphur, the smoke from which, after ignition, is blown into the drain or pipes. If leakage exist in the latter inside of the house the smoke and smell both issue forth and show that something is wrong, and generally tells just where the fault or faults exist.

Sulphur, as is well known, is one of the best of disinfectants, and a dose of the fumes from this to the drains, after disease has been in the house, would effect much good.

The Odors of Paris.—H. Sainte Claire Deville has analyzed samples of the dark soil which immediately underlies the pavements of Paris, and finds that the odors which arise from it are in no wise injurious, on account of the empyreumatic and antiseptic products which are constantly introduced by the illuminating gas that escapes from the street mains.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Gas Engines and the Electric Light.

PHILADELPHIA, April 28th, 1881.

To the Editor AMERICAN GAS LIGHT JOURNAL:

The item reproduced from the New York *World*, in the last issue of your valuable paper, under the heading "Edison Tries His Lamps," may tend to give to a number of your readers, less familiar with matters connected with gas engines, the impression that these motors are not suitable generally for electric lighting; and in view of the great interest which is being constantly manifested by gas men in the utilization of gas for power purposes, we feel it is due to them and ourselves that they should have the correct information.

The accompanying testimonial of the agent of the Brush Electric Light attests the adaptability of the Otto engine to his machines, as well as reports we have from other engines of our make running this system of electric lighting. Amongst the various electric machines now in vogue, some are more sensitive to the irregularities of the motive power, and others are less. Gas engines having two working cylinders, and two heavy fly-heels, thereby possessing a higher degree of regularity than our ordinary engines, have been built and furnished in single instances to run the more sensitive machines.

The same construction was also recommended by us for the Edison incandescent light, which possessing an infinitely smaller current in the very thin film of each single lamp than any arc light, will lose its incandescence promptly by the least uneveness of the current due to the irregularity of the power.

Our double cylinder engines were, however, not adapted for the experiments carried on at the new headquarters of the Edison Electric Company, as the time required to furnish them appeared to be too long, and the result of two of our ordinary engines was, as could have been naturally expected, as reported in your paper.

In connection with the preceding communication, it may be of interest to your readers to hear that the Compagnie Francaise des Moteurs à Gaz, of Paris, has contracted to furnish the power for one main line of shafting, at the Paris Exhibition of Electrical Apparatus, from Otto engines exclusively. The total amount of power furnished will be of 200 actual H.P., made up from several sizes of engines, amongst them some of 50 and 25 H.P. The price at which the power is furnished to the Exhibition is 15 centimes (about three cents) per horse power per hour.

Respectfully yours,
SCHLEICHER, SCHUMM & Co.

NEW ORLEANS, April 22, 1881.

JOHN F. BRAUN—

Dear Sir: The seven-horse power Otto gas engine, manufactured by Messrs. Schleicher, Schumm & Co., Philadelphia, and put up by you last October at Wenger's Garden, in this city, to run one of our six-light machines—No. 5—has been running four good steady lights ever since it was put up.

I expected the speed to slacken every other revolution so as to affect the lights, but was, happily, disappointed. I have further observed that when the engine is cleaned, and in good order, the speed is not diminished enough to be perceptible in the lights when the cam is skipped. In putting up our machines to be run by your engines, I always expect to give satisfaction.

Yours respectfully,
GEORGE O'CONNER,
Agent for Brush Electric Light.

Mr. Pearson in Reply to Mr. Hague.

CONSUMERS GAS COMPANY,
TORONTO, April 25, 1881.

To the Editor AMERICAN GAS LIGHT JOURNAL:

The claims of more important matters have prevented my giving earlier attention to a communication from the irrepressible Mr. John Hague, published in your issue of March 16th.

My mild allusions to this gentleman and his statements in my reply to his uncalled-for attack upon this company, seem greatly to have disturbed his equanimity, and to have caused him to pen an epistle in which he manifests such vindictiveness and unfairness as to render it unworthy of a reply. This letter, however, is a great improvement upon what purported to be an "advance copy," containing some offensive allusions to myself (omitted in the letter sent to you) sent by him to a Toronto paper—the impropriety of publishing a reply in a paper in which the letter replied to did not appear, seemingly not having occurred to him.

Were it not that I thought that some of your readers may not have read both my letter and Mr. H.'s reply, I should not trouble you with this communication, as anyone who has done so will have seen that he has misquoted or misrepresented what I said throughout. As it is I shall merely refer to two or three instances, in which he has done one or the other, as samples of the rest.

For example—he utterly ignores my explanation that when I said we had no trouble with the gas in warm weather, I had reference solely to the naphthaline difficulty, and that what I said was not fully reported. The naphthaline stoppages did not occur until after a very sudden fall in the temperature on the 7th or 8th September, and although it did not freeze until somewhere about a month afterwards, the weather was not what could be called warm. The sudden change in the weather referred to undoubtedly caused the naphthaline deposits here as it did elsewhere.

Again, in making me say, "A man was sent to Mr. H.'s residence in July and another in August, and reported that the trouble arose from their being closed with a carboniferous deposit," Mr. Hage deliberately misquotes me for the purpose of holding me up to ridicule. What I did say was—

"A man was sent to Mr. H.'s residence in July, and another in August. *They changed some of his burners*, and reported that the trouble arose from their being closed up," etc.

I neither affirmed no denied that there was a viscous, tarry substance in Mr. H.'s pipes, but merely gave the statements of the men who were sent to his house. These men have since re-affirmed what they said, and the man who blew out the pipe positively asserts that Mr. H. was not present at all, either when he uncoupled, blew out or re-connected it, and that the stoppage was caused solely by naphthaline.

It would hardly be worth my while referring to this, were it not that reports have been frequently circulated that our pipes were being closed up with tarry deposits. I have already stated, in previous communications, that no difficulty had been experienced here from such stoppages, and I would now say that, since the date of my last letter, none have been reported to me, nor are any apprehended.

As to whether or not my "gas operations," or those of any one else connected with this company are "scientific," and my letters "full of inaccuracies and contradictions," Mr. H. is evidently not qualified to judge. It must at all events be evident to anyone who has read this correspondence that he is not exactly the proper person to "throw stones" at parties who may be guilty of such faults as incorrectness and inconsistency of statement.

I might here add that Mr. H. has for many years filled the position of accountant to a highly respectable firm. I have never heard of his having anything to do with the manufacture of gas; and, to the best of my knowledge, he has never been in the Toronto gas works, nor seen the Lowe Process in operation.

The Lowe Process does "work" here, and we have had no further attacks from that enemy of all gas companies—called by the President of the New England Association of Gas Engineers, at the last meeting of that Association, "that outlaw, bummer, guerilla—naphthaline."

I have most reluctantly sent you this communication on what is principally a personal matter, and assure you that it is not my intention to continue further a correspondence which cannot be of interest to your readers generally.

Respectfully yours,
W. H. PEARSON.

Prices of Gas Coals.

The competition between the principal coal carrying railroads for the gas coal trade of New York and the New England States has resulted in a reduction of prices, averaging about fifty cents per ton below those of 1880.

Contracts for the bulk of the requirements for the coming season have been made at 4.62½ for Youghiogheny and Kanawha coals, delivered at New York; while the West Virginia coals range from $4.25 to $4.50.

Provincial gas coals cost $3.50 to $3.60 to import; Abram gas cannel, $9.00; Cannelton cannel, $8.50; Ince Hall gas cannel, $6.00 to $6.25.

THE ELECTRIC LIGHT IN FRANCE.—It is announced that the several companies which are separately working the Jablochkoff, the Gramme, the Jamin and the Werdermann electric systems in France have determined upon uniting their interests into one general association, the arrangements for which are being carried out under the auspices of one of the leading financial institutions of Paris.

FINE LUBRICATING OIL.—Put fine olive oil in a bottle with scrapings of lead and expose it to the sun for a few weeks. Pour off the clear oil for use.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

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MONDAY, MAY 16, 1881.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 PINE STREET, NEW YORK CITY.

MAY 16, 1881.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

Gas Co.'s of N. Y. City.

	Capital.	*Par.*	*Bid.*	*Asked*
Central	$466,000	50	60	65
Harlem	1,800,000	50	74	78
" Bonds	170,000			103
Manhattan	4,000,000	50	175	180
Metropolitan	2,500,000	100	136	138
" Scrip	1,000,000	...	102	103x
Mutual	5,000,000	100	65	67
" Bonds, go'd.	900,000	1000	100	104
Municipal	1,500,000	100	150	155
" Bonds	750,000		106	110
New York	4,000,000	100	90	93
Northern	270,000	50	—	100

Gas Co's of Brooklyn.

Brooklyn	2,000,000	25	110	115
Citizens	1,200,000	20	45	50
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	55	60
Peoples	1,000,000	10	25	30
" Bonds	290,000	.	101	104
" "	250,000	...	70	75
Metropolitan	1,000,000	100	55	60
Nassau	1,000,000	25	45	48
" Ctfs.	700,000	1000	95	100
Williamsburgh	1,000,000	50	50	55
" Bonds		...	98	103
Kings Co	135,000	100	55	60
" Bonds	40,000	—	—	—
Richmond Co., S. I.	300,000	...	70	75

Out of Town Gas Companies.

Buffalo Mutual, N.Y	750,000	100	72	76
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			71	72
Bonds			137	—
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150.000	40	117½	
Jersey City	750,000	20	140	150
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo.	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	153	154
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	95	100
" " Bds.				5
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	30	35
Woonsocket, R. I.	150,000	100	80	...
Wilmington, Del.		50	174	...
Yonkers		50	30	32
Rondout & Kingston			75	80
St. Louis Missouri	600 000	50	250	254
San Francisco Gas-Co., S. Fr'sco Cal.			70	71
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C.	1,500,000	20	130	200
" Scrip	500,000	20	150	160

The following shares were sold at auction: 51 New York at 91 1-2-94 1-2; 165 Yonkers, at 33; 100 Manhattan at 177¼-177¾; 10 Central at 61¾. $1,500 Nassau, Brooklyn, scrip, at 95.

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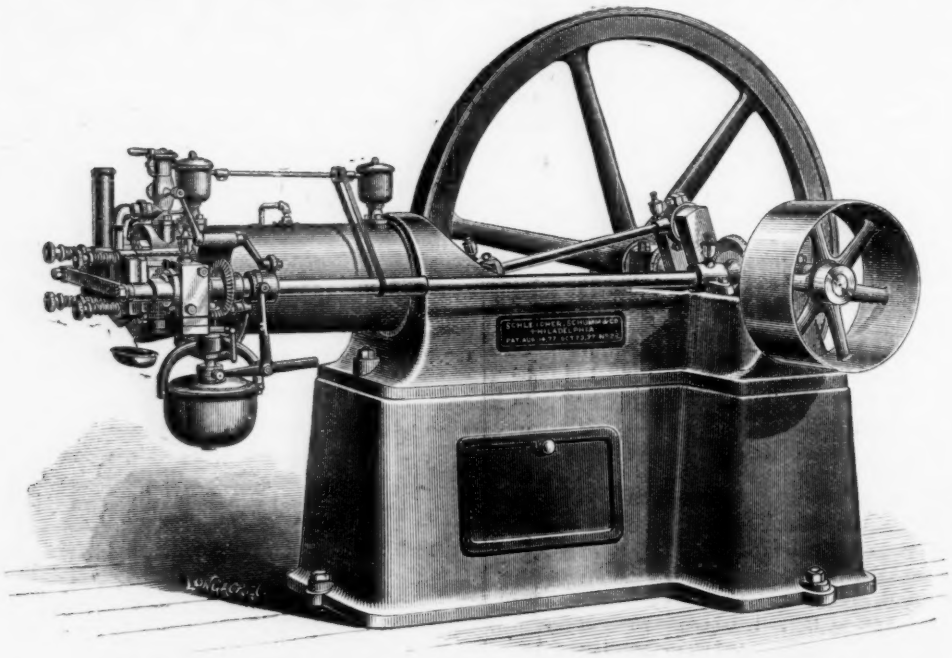

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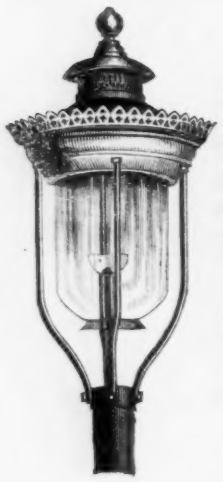

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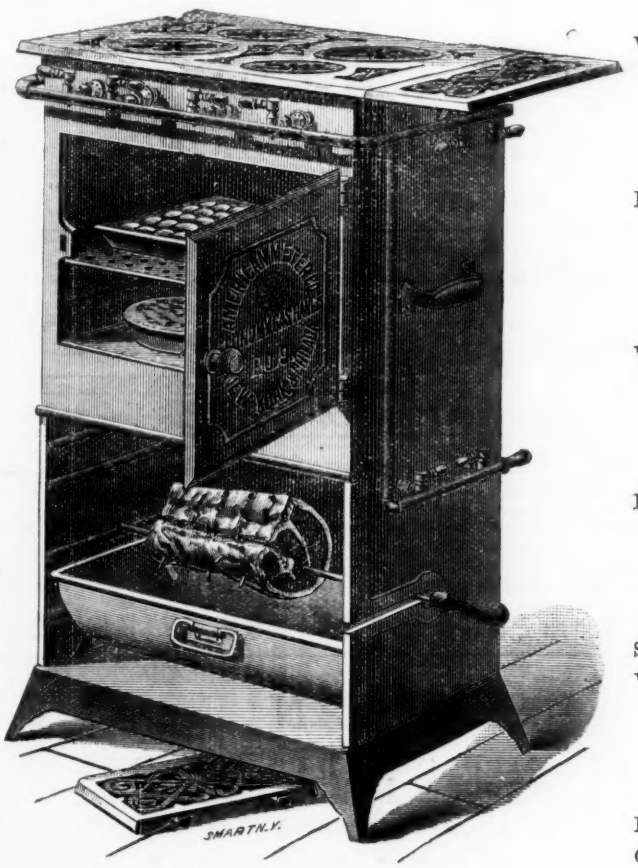

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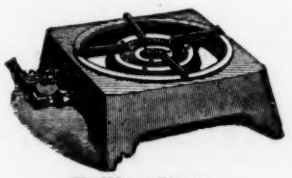
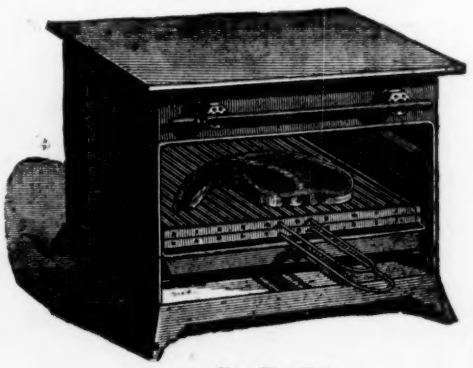


Boiling Stove.



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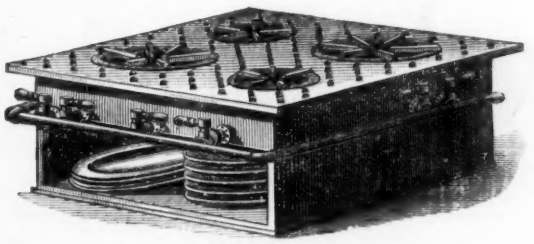
All Qualities of Gas can be Used.



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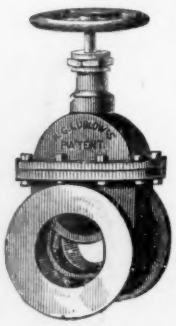

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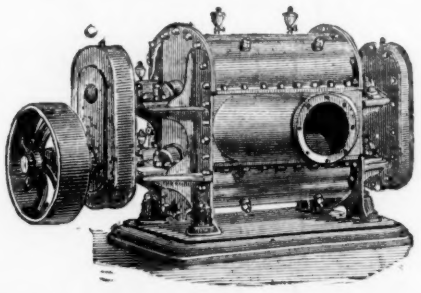

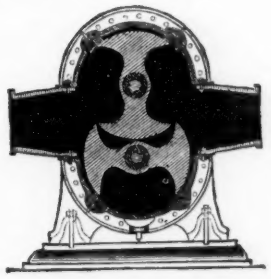

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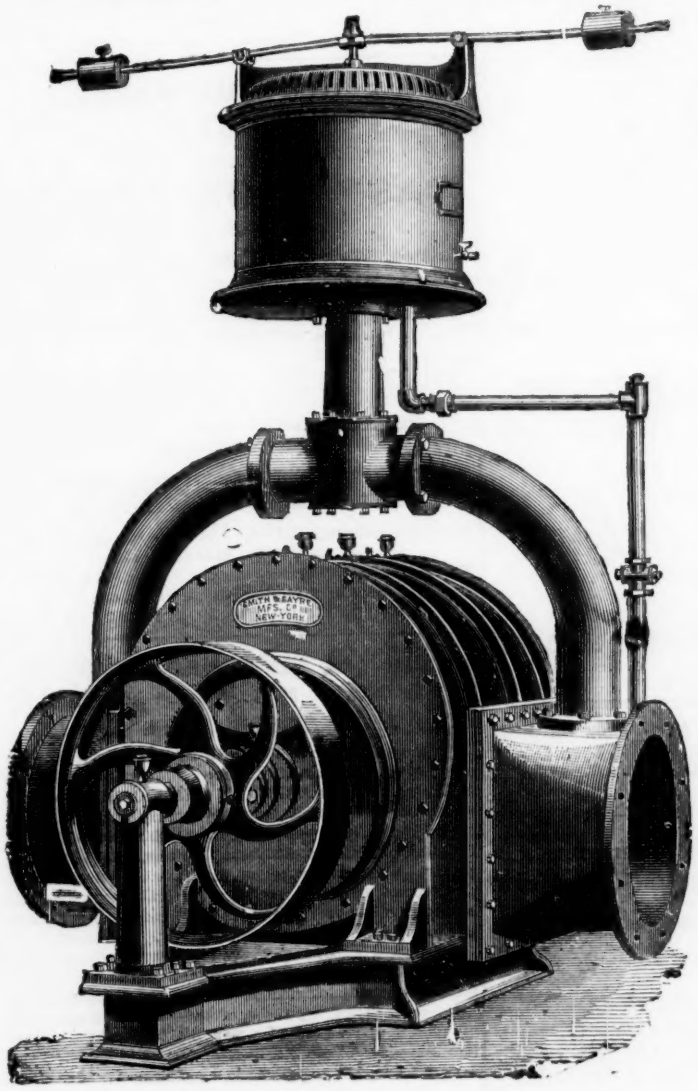

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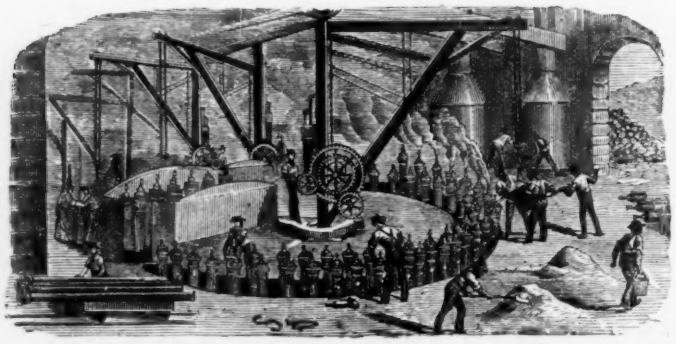

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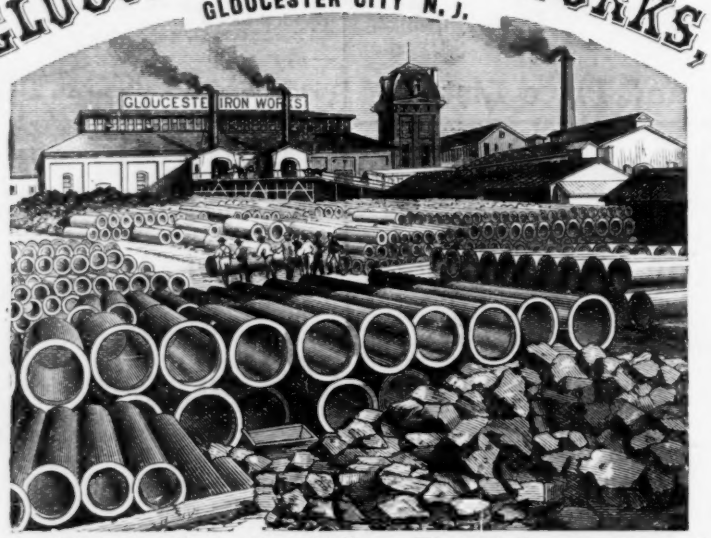

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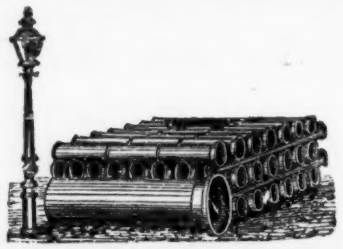

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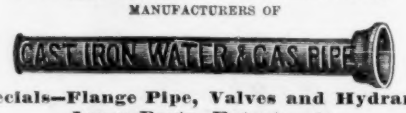

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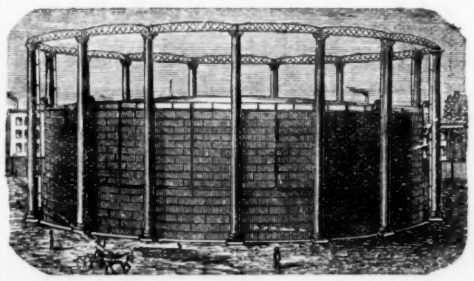

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This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation. on most favorable terms.

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W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY. Agent
351-1y at Cleveland, Ohio.

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.
CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

Ithas been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to he Mannattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.
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Wharves Locust Point, } Baltimore.
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Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine
*** Reference to them is requested. 204-

THE
PENN GAS COAL COMPANY

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Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station on the Pennsylvania Railroad, and on the Youghiogheny River.

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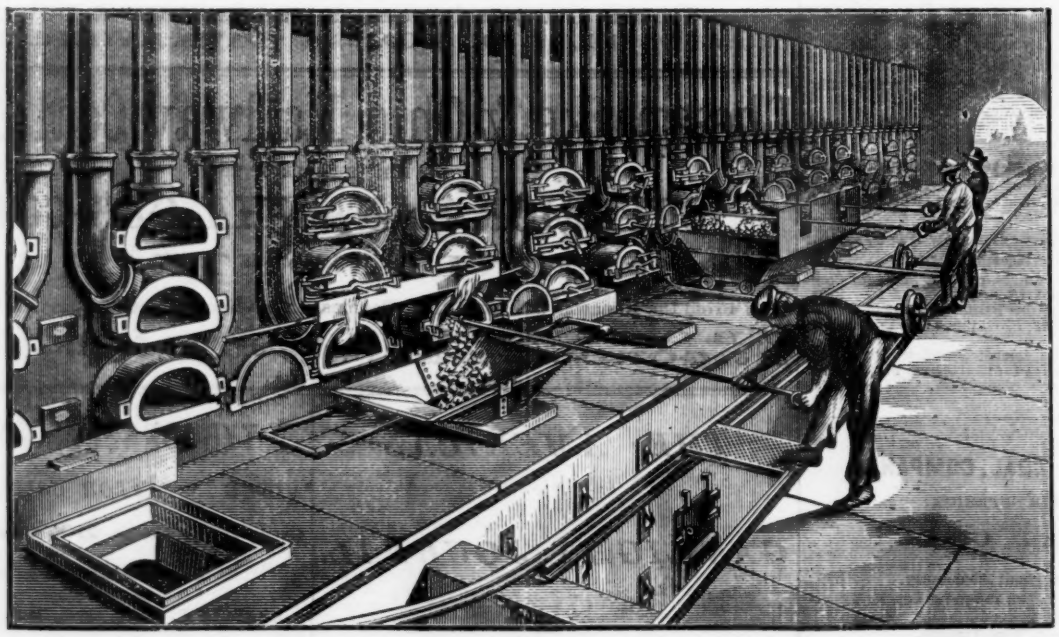

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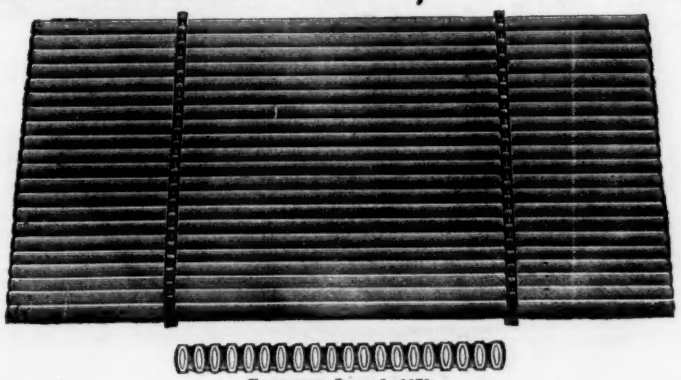

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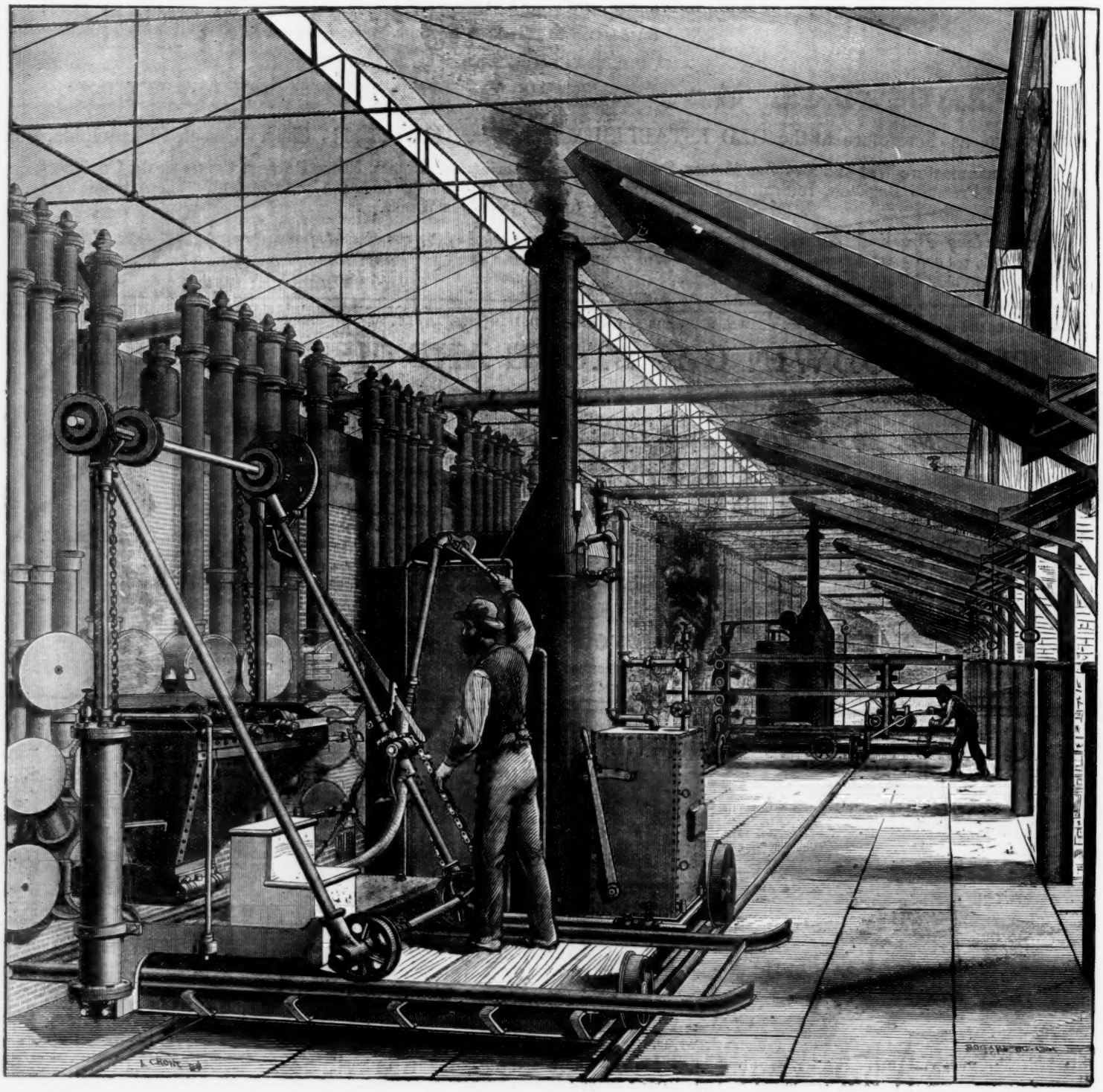

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